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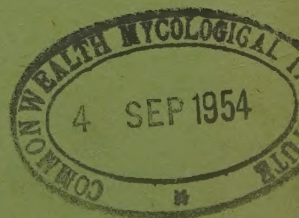


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ANNUAL REPORT
OF THE
INDIAN COUNCIL OF
AGRICULTURAL RESEARCH
FOR
1951-52

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SUMMARY

GENERAL

OFFICIAL CHANGES. There have been a few changes in the organisation. Shri J. V. A. Nehemiah succeeded Shri S. R. Maini, I. A. S., as Secretary of the Council. Dr P. V. Sukhatme, whose services were lent to the F. A. O. of the United Nations, was temporarily succeeded by Dr V. G. Panse, Director, Institute of Plant Industry, Indore. Shri R. L. Sethi, the Agricultural Commissioner, retired from service.

MEETINGS. Fifty-three meetings of the various organisations of the Council were held during the year under report. The Prime Minister of India inaugurated a joint function of the meetings of the Governing Body of the Council and the fourth Convocation of the Statistical Training Centre and gave away the diplomas to the successful students and certificates of '*Krishi Pandit*' and prizes to the winners in the All-India Crop Competition.

ALLOTMENT OF FUNDS. The Council sanctioned the continuation of 80 current research schemes (51 on the agricultural side, 26 on the animal husbandry side and three miscellaneous) at a cost of Rs. 27.36 lakhs. Fifty new schemes (22 on the agricultural side, 19 on the animal husbandry side and nine miscellaneous) were sanctioned during the year under report at a total cost of Rs. 14.19 lakhs (round). Twenty-eight research schemes terminated during this year.

EXTENSION WORK. The Council's resolutions in the past for initiating extension work were made effective by the appointment of an Agricultural Extension Commissioner in the Council with corresponding appointments in the States. With assistance from the Ford Foundation, the Council has undertaken to run 15 Extension Development Projects and 30 Extension Training Centres for making available scientific information to the farmers by practical demonstration through multipurpose village level workers and supervisory extension staff specially trained. The Council has also been closely associated with the agricultural aspects of the Community Projects which were being opened in different parts of the country with assistance from the Technical Co-operation Administration. The Council has also assumed responsibility for operating a Ford Foundation scheme of opening extension departments in six selected agricultural colleges with a view to providing extension education at University level.

VICE-CHANCELLORS' CONFERENCE. In pursuance of the recommendations made at the Conference sponsored by the I.C.A.R. of the Ministers for Agriculture in States, and Vice-Chancellors of the Universities having agricultural and animal husbandry colleges under

them, an Indian Council of Agricultural Education has been set up under the aegis of the I.C.A.R. to co-ordinate agricultural education for achieving an uniform standard of such education in the country.

LAND ARMY. Steps have been taken to organise a Land Army; the campaign for recruitment to the Land Army was initiated by the President in June, 1951 and response from every quarter has been quite favourable.

SEMINARS OF EXTENSION WORKERS. A seminar of agricultural extension workers was held in Delhi and another at Indore.

CROP COMPETITION. Crop competition fortnights were organised throughout the country twice a year immediately before the *khari* and *rabi* sowings. Response was encouraging.

PUBLICATIONS AND PUBLICITY. The reformed '*Indian Farming*' is now published from Bombay with its more attractive format. It is now designed to serve the interests of the Indian farmers to a wider extent and carries besides feature articles, topical notes, etc., special interviews with farmers and material for guidance on day to day agricultural operations. Thus the journal has been made popular and the treatment of articles published therein is absolutely non-technical and easily comprehensible to the layman.

The Council also undertakes preparation of non-technical extension literature in the form of pamphlets for distribution among extension workers in the villages and Community Project Areas. Some of the contemplated pamphlets have already been prepared and a few more are in the press.

A new quarterly periodical entitled '*Statistical Newsletter*' was stated. This publication covers the activities of the Statistical Section of the Council as also other news items of interest to the world; besides, the articles of a popular nature explaining the scope and progress of statistical investigation are also published therein. Publication of another new quarterly periodical under the name of '*Rice News Teller*' containing current matters of interest and activities of paddy workers in different parts of the country is contemplated. In addition, a number of scientific monographs and bulletins were also published.

AGRICULTURE

General. A Conference of Rice and Wheat Research Workers was held at Coimbatore from 27 to 29 July, 1951, which made a number of valuable recommendations in regard to better and increased production of the two crops. These recommendations were subsequently endorsed by the joint meeting of the Boards of Research and Extension held at Coimbatore.

The ninth meeting of the Crops and Soils Wing was held at Indore ; in conjunction with this a joint meeting of the Boards of Research and Extension, a seminar of Extension Workers and a Directors' Conference were also held. The Wing considered many subjects, for instance, mechanisation of agriculture, scientific manuring of crops, locust menace, green manuring methods, etc. and made many important recommendations in this respect.

In accordance with the recommendations made by the Governing Body of the Council at its meeting held in 1950, the State governments, commodity committees and Central institutes submitted to the Council their annual reports and technical programmes of work for effecting co-ordination of agricultural research with a view to avoiding, as far as possible, unnecessary duplication and overlapping, effecting economy in expenditure and ensuring proper utilisation of the available technical personnel. The remarks of the scientific committees of the Council on these reports and programmes were duly communicated to the States, commodity committees, etc.

Plant introduction. Several Chinese varieties of paddy have been grown and multiplied in Kashmir. Some of these varieties have also shown promise in West Bengal. In Bombay, some selections have proved superior to the local varieties. Likewise, improved varieties are being evolved in Hyderabad and investigations on economical manuring schedules are being carried out. In the Punjab and West Bengal too, selections of Chinese varieties of rice suited to the local conditions are in progress.

As regards rice pests, hispa and stem borer, investigations in Bengal indicate that the stem borer is more active in the first half of the night than in the latter half, work on the control of these pests is being carried on.

The fungal pests of rice, blast disease and foot-rot, are under investigation in Madras. Long duration blast-resistant varieties have already been evolved and work on the production of short duration types is in progress. Foot-rot being a seed-borne disease is successfully controlled by pre-treatment of seeds by organo-mercuric fungicides.

In Bengal, the effect of ammonium sulphate on the yield of grain and straw has been generally found to be favourable. Investigations are continuing on *Helminthosporium* and it has been discovered that nitrogenous fertilisers tend to make the plants more susceptible to this disease while phosphates tend to increase resistance to infection of the pathogen.

Wheat. Another important foodgrain, wheat, suffers from a disease known as rust which has three types—black, red and yellow. Varieties have already been evolved which are resistant to one kind of rust ; it is expected that before long a type will be produced which will be resistant to all the three kinds. To achieve this end, a co-ordinated wheat rust control scheme has been sanctioned at Delhi, Pusa, Simla and Indore

Promising results have also been reported in wheat research schemes at Madhya Pradesh and Bombay.

Maize and millets. The Council has recently encouraged the work on hybridisation of maize to increase yield over the local varieties at a number of places, the main centres being the I.A.R.I., Punjab, Uttar Pradesh, Bombay and Hyderabad. The first step in the programme of production of local inbreds has been successfully completed; the next stage of crossing them in suitable combinations for high yields of hybrids is in progress. Investigations and trials have indicated the possibility of obtaining two crops of maize in a year. Schemes for improvement of larger millets were in operation in Madras, Uttar Pradesh, Mysore and Saurashtra. The two Madras schemes were for the production and distribution of hybrid *bajra* and for investigation on the striga attack on sorghum. Promising strains of *sawan*, *kodon*, and *ragi* in U.P. have been evolved.

Pulses. The Council has been financing a co-ordinated scheme of researches in almost all the States on various pulses. Promising varieties of gram capable of giving high yields have been evolved in Bengal, Bombay, Hyderabad, Uttar Pradesh, Madhya Bharat, Madras and Orissa. Possibility of controlling the wilt disease of gram in the Punjab by cultivation and cropping methods was explored. Besides giving a better yield than the local ones, the Bombay strains of the Bengal gram have shown a high degree of resistance to the wilt disease. Likewise, better strains of red gram have been evolved in Madras, Bombay, Bengal and Uttar Pradesh; of green gram in Bombay, Orissa, Madhya Bharat, Madras and Uttar Pradesh; of black gram in Assam, Bombay, Orissa, Madhya Bharat and Madras; of horse gram in Bombay, Orissa, Hyderabad and Mysore and of lentils and peas in Uttar Pradesh. Possibilities of soyabean-wheat rotation were explored at Almora. Interesting information on the suitability and economics of growing black gram mixed with paddy in Orissa was found to be advantageous. *Jowar*, red and green grams grown as mixed crops in Madhya Bharat proved to be profitable. Similar results were obtained when red gram was grown as a mixed crop in association with *jowar* or groundnut in Hyderabad.

Spices and condiments. A number of schemes on important cash crops of spices and condiments in various parts of India were also financed by the Council. Those on cardamom, ginger, chillies and pepper were in operation in Madras; on cloves in Travancore; on turmeric in Orissa; on coriander in Madhya Bharat and on *jira* in Rajasthan. Investigations on better and large production through breeding high yielding varieties, on prevention of pests and diseases, etc. have been successfully carried on.

A sub-committee of the I.C.A.R. has been set up to examine the various aspects of production and marketing of some important dollar-earning crops like pepper, cardamom, cashewnut, ginger, lemon grass, etc. and to consider whether centralised direction in these fields is necessary and if so in what form.

Horticulture. Investigations were also conducted on various aspects of fruit growing in case of mango, citrus, banana and apples. Studies on the gall makers of mango leaves and shoots were continued in the plains of Uttar Pradesh. In regard to citrus, various research schemes were in progress in Madhya Pradesh, Madras, Assam, Orissa and Coorg with a view to finding out the best varieties, suitable scionic combinations and quick and easy methods of propagations. In the States of Uttar Pradesh and Bombay, schemes to breed new varieties, improve cultural methods, study manurial requirements and control pests and diseases of vegetables were also in progress.

Insect pests and plant diseases. Concrete results were available in regard to tests carried out with the DDT and allied insecticides at the I.A.R.I., Bombay, Madhya Pradesh, Madras and Uttar Pradesh where prophylactic, preventive and control measures in respect of a large number of crop pests such as *singhara* beetles, mustard aphids, potato *Epilachna* beetle and mangooppers had been devised. Similarly, the relative efficacy of BHC and DDT in destroying insect pests of stored cereal grains was investigated in the Punjab. Interesting information was also available on some virus diseases. Six cowpea varieties were tested for resistance or tolerance to the virus by mechanical inoculation.

The work of eradication of the 'Kattee' disease was extended to another 450 acres in North Kanara. Various species of aphids tested were found to pick up the virus from affected papaya plants in feeding periods of three minutes.

ANIMAL HUSBANDRY AND DAIRYING

Research schemes already under way during the year at the various research centres made further progress. New schemes initiated were as follows : (1) Selective breeding and grading of indigenous cattle at Orissa, (2) A diploma course for training in Sheep Husbandry and Wool Technology, (3) Development of sheep and goats for mutton purpose, (4) Pilot work to improve milking capacity of two draught breeds, viz. Kangayam and Hissar, was carried on and a special committee was set up to study the results obtained.

Livestock breeding. During the year the Planning Commission approved the 'Key Village Scheme'; recognition was thus awarded to the pilot schemes already functioning in the States of Delhi and Uttar Pradesh. A similar pilot scheme commenced working in Travancore-Cochin.

Artificial insemination was tried out with fair success. Other aspects of cattle development, viz. breeding, feeding, disease control, management and marketing were given due attention.

The scheme for the improvement of sheep and wool on a regional basis comprising three regions, viz. the temperate (Himalayan), the dry (northern) and the southern (Deccan) was put into operation, in Bombay, Uttar Pradesh and Kashmir.

Animal nutrition. The first regional centre for animal nutrition was opened at Anand, in January, 1952.

The plan for the determination of the nutritive value of indigenous grasses and leafy fodders at the feeding stage originally sanctioned in 1944 at the I.V.R.I. continued to make satisfactory progress. In the same Institute a systematic study to determine the dietetic requirements of lambs necessary for health and optimum growth was undertaken. Metabolic effects of hormones in relation to induce lactation were studied in the U.P. College of Veterinary Science, Mathura.

Schemes were sanctioned, State-wise, to set up standards of quality control of milk.

Studies on granulation and texture of *ghee* showed that the size of the grain depends more on the shape and size of tins than on the mode of filling.

Disease control. New Disease Investigation Schemes have been started in PEPSU, Madhya Bharat, Saurashtra and Kutch.

Large-scale vaccination in order to test the nature and duration of immunity produced by lapinised vaccine, is contemplated for the control of rinderpest. A large number of animals have been vaccinated in the Punjab and Madras with varying results in the case of Goatis and desiccated vaccine. Mastitis was investigated and efforts were made to determine the efficacy of different chematherapeutic agents. Six more viable strains from field outbreaks of foot and mouth disease were typed and added to the 67 Indian strains typed and isolated so far. It was found that Crystal Violet vaccine conferred solid immunity of an order superior to that of the Gel vaccine. Investigation of such other diseases as contagious abortion, pleuro-pneumonia and helmenthiasis also continued. The incidence of tuberculosis among cattle was studied and 42,500 doses of concentrated synthetic tuberculin were prepared.

The Animal Health Information Service issued 55 bulletins since its inception in 1947, which gave latest information regarding the prevalence of important diseases of livestock, and helped in the adoption of control measures.

AGRICULTURAL STATISTICS

The advisory research and teaching activities of the Statistical Branch were carried on during the year. The number of persons who received training in agricultural statistics during the year under report was more than thirty-five.

Sample surveys for the estimation of yields of crops were extended during the year to all principal crops in the States. A bulletin giving a useful, cumulative account of the surveys so far carried out

was published. Similar surveys for evaluating the results of the 'Grow More Food' campaign were also made in the various States and a further survey to spot-check irrigational works showed progress. An extension of the technique of the sample survey for estimating the acreage under principal crops, first started in Orissa, to other parts of the Union, was considered.

To find out the possibilities of improving upon the quantity and quality of wool and thus helping the sheep breeders raise better flocks, was the object of a scheme sanctioned by the Council in which the records of ten years (1937-46) will be critically analysed.

DEVELOPMENT

The Rehabilitation Scheme in Baroda proved very successful. Improved agricultural practices were introduced and adopted by the farmers. As a result, high yields were obtained. The scheme has been extended for another two years to study collective farming methods.

This is the fourth year of the Delhi Development Scheme. In addition to the establishment of improved cultural practices and the use of improved implements and seeds, the activities of the scheme compassed training of local cultivators in self-help.

In the field of animal husbandry, progress has been traced in the Council's efforts to introduce improved breeds of poultry and pigs and provide fisheries. The preliminary house-to-house survey under the Key Village Development Scheme was completed.

The Milk Supply Scheme initiated in February, 1951, expanded so greatly that it could not be contained in a private local dairy. Hence a sum of Rs. 3.55 lakhs was sanctioned and arrangements were made by the Council to set up a fully-equipped dairy of its own.

ANNUAL REPORT

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1951-52

CHAPTER I.—ADMINISTRATION

GENERAL

This 22nd Annual Report of the Indian Council of Agricultural Research presented by its Governing Body under Rule 64 of the Rules of the Council, gives a general review of the work of the Council during 1951-52.

Initiation of Extension Work

During the year the Council has maintained steady progress. Agricultural Research will merit and will receive public support in proportion as the results of research are translated into field practice appropriate to the conditions in which the cultivator works. The Council's resolutions in the past for initiating extension work for this purpose were translated into practice by the appointment of an Agricultural Extension Commissioner in the Council with corresponding appointments in the States. With assistance from the Ford Foundation, the Council has undertaken to run 15 Extension Development Projects and 30 Extension Training Centres for making available scientific information to the farmers by practical demonstration through multi-purpose village level workers and supervisory extension staff specially trained. No expenditure is involved to the Council as it is shared by the Ford Foundation, the Government of India and the State Governments. The Council is also closely associated with the agricultural aspects of the Community Projects which are being opened in different parts of the country with assistance from the Technical Co-operation Administration.

The Council also assumed the responsibility for operating a Ford Foundation Scheme of opening extension departments in six selected agricultural colleges with a view to providing extension education at the University level.

Crop competition, which is an important adjunct to agricultural extension work is now being organised by the Council. Crop competition fortnights were organized throughout the country twice in a year immediately before the *khariif* and *rabi* sowings in order to enlist more and more competitors.

Vice-Chancellors' Conference

The Council took the initiative in convening a Conference in 1951 of the Ministers for Agriculture in States, Vice-Chancellors of the Universities having Agricultural and Animal Husbandry Colleges under them and other interests concerned, to consider the important question of reorganising agricultural education to give it a practical bias in the light of present day requirements. In pursuance of the recommendations made at this Conference, an Indian Council of Agricultural Education has been set up under the aegis of the I.C.A.R. to co-ordinate agricultural education (including animal husbandry and dairying education) in the country and to advise the Council and Government on all aspects of agricultural education. .

FINANCE AND ACCOUNTS

The following were the receipts from (i) the cess levied under the Agricultural Produce Cess Act, 1940, and (ii) the grants received from the Government of India and from other sources.

	Rs.
(i) Receipts from the cess	44,24,072
(ii) Grant from the Government of India for crop-cutting experiments on jute	18,500
(iii) Grants from other sources	
(a) Towards the Publicity Fund	35,000
(b) For headquarters expenditure in connection with the crop-cutting experiments	2,57,031

A statement showing the audited accounts of the Council for 1951-52 is appended (Appendix XVI).

MEETINGS

Fifty-three meetings of the various organizations of the Council were held during the year (Appendix I). The Prime Minister of India inaugurated a joint function of the meetings of the Governing Body of the Council and the fourth Convocation of the Statistical Training Centre and gave away the diplomas to the successful students and certificates of '*Krishi Pandit*' and prizes to winners in the All-India Crop Competition.

OFFICIAL CHANGES

There had been a few changes in the organization. Shri J. V. A. Nehemiah succeeded Shri S. R. Maini, I.A.S. as Secretary of the Council. Dr P. V. Sukhatme, Statistical Adviser of the Council whose services were lent to the F.A.O. of the United Nations, was temporarily succeeded by Dr V. G. Panse, Director, Institute of Plant Industry, Indore. Shri R. L. Sethi, the Agricultural Commissioner, retired from service.

ALLOTMENT OF FUNDS

The Council which influences agricultural research in co-operation with States, Universities and private institutions, sanctioned the continuance of 80 current research schemes (51 on the agricultural side, 26 on the animal husbandry side and three miscellaneous) at a cost of Rs. 27.36 lakhs. Fifty new schemes (22 on the agricultural side, 19 on the animal husbandry side and nine miscellaneous) were sanctioned during the year at a total cost of Rs. 14.19 lakhs (round) to the Council (Appendix II). Twenty-eight schemes terminated during the year (Appendix III).

EXTENSION

Agricultural Extension Service

In pursuance of the resolutions passed at the Joint Meeting of the Governing Body and the Advisory Board of the Indian Council of Agricultural Research held at Dehra Dun in May, 1951, all the State Governments were requested to formulate and forward to the Council schemes for the establishment of an Extension Service Organisation in their respective States. In response, schemes have been received from most of the States and Joint or Deputy Directors of Extension have been appointed in Bombay, Bihar, Madras, Orissa, Punjab, PEPSU, Bhopal, Coorg and Kutch. Proposals from other States are under consideration.

Appointment of Agricultural Extension Commissioner at the Centre and Directors of Extension in States

At the Centre (in the Indian Council of Agricultural Research) a full time Agricultural Extension Commissioner to be in charge of the extension activities with a nucleus staff has been appointed. He will advise the State Governments in regard to the Extension Service Schemes and will also initiate the development of extension activities throughout the country and will co-ordinate the same.

Setting up of Boards of Extension at State, District and Tehsil Levels

Boards of Extension have been set up at State, district and *tehsil* levels in certain States and steps are being taken by others to do so. A Board of Extension has also been set up at the Centre under the I.C.A.R.

Pilot Development Projects

An agreement has been signed between the Government of India and the authorities of the Ford Foundation under which a programme of economic co-operation over the next five years in the case of the extension projects and over the next three years in the first instance, in

the case of the extension training centres is proposed. Under this programme and within financial assistance from the Foundation, five extension training centres and 15 extension development projects have been allotted to different parts of the country. The training centres are located in different regions of India in a manner that they would meet the needs of various States in that region and will train up key extension personnel for the manning of future projects. To each such training project is assigned an extension project where the staff will actually work with their own hands all the improvements which they will translate to the farmers' conditions. So far definite schemes submitted by the U.P., M.P., Bombay, West Bengal, Mysore, Assam, Bihar, Orissa, Himachal Pradesh, PEPSU, Hyderabad, Madhya Bharat, Bhopal, Vindhya Pradesh and Travancore-Cochin have been sanctioned.

The area covered by each project and its cost are detailed below.

Training-cum-Development Projects

	A R E A	C O S T Rs.
1. Bombay—Charotar Tract (Anand)	278 sq. miles	4,53,300/- (for 2 years only.)
2. W. Bengal—Burdwan	62 sq. miles	8,35,600/-
3. Mysore—Viseswarayya Canal Farm	100 villages (area not available)	8,52,500/-

Pilot Development Projects

1. Bihar—Bihta (Patna)	66 sq. miles	4,09,700/-
2. Assam—Rangiya (Kamrup)	113.9 sq. miles	3,89,100/-
3. PEPSU—Bhadson	148 sq. miles	4,68,300/-
4. Himachal Pradesh } Narkanda on Hindu- Pradesh } stan—Tibet Road	91.8 sq. miles	4,42,300/-

In addition to the above, 25 more training centres subsidised by the Ford Foundation are being established throughout the country. These training centres will work in two shifts and with double staff, to train the supervisory staff and the village level workers required mainly to man the Community Projects.

Land Army

Any extension service to be successful should associate not only officials but also farmers and the public who are capable of doing good work. Measures have, therefore, been initiated to organise a Land Army to utilise the considerable enthusiasm in the country among non-officials, students, teachers and rural people for collective work. The Land Army is divided between the auxiliary branch which would consist of the urban and the volunteer worker element and the regular

branch, that is, a regular farmer. The campaign for recruitment to the Land Army was initiated by the President in June, 1951. The States of Delhi, Bombay, West Bengal, Assam, Orissa, Vindhya Pradesh and Bhopal have formed Land Army Units which have been doing useful work in implementing specific agricultural programmes chalked out in order to do production work in an organised manner. The organization of the Land Army in some of the States is given below.

Vindhya Pradesh.—Land Army has been organized in 20 villages.

Bhopal.—Land Army has been organized in 54 villages ; total number of members so far is 460.

Orissa.—Land Army has been organised in 91 villages, the number of members being 367.

Delhi.—The first unit was formed in June, 1951, consisting of 30 University students, about 100 village teachers and some actual farmers. Post-graduate students and staff of the I.A.R.I., New Delhi, have organised themselves into an auxiliary corps of Land Army. It has 13 working units of 15 volunteers each including the unit leader.

A scheme for the training in the extension work of 100 ex-Army personnel with a view to employ them as instructors in the colleges and schools to train students in agricultural extension work and organise land army units has been drawn up and submitted to the Government of India for sanction.

Seminars of Extension Workers

A seminar of agricultural extension workers in the country was held in Delhi and another at Indore. A very useful record of proceedings for the guidance of future extension workers was published. One of the important recommendations made at the Indore seminar was that the Indian Council of Agricultural Research should convene at an early date an all-India Convention of representative interest in agriculture (both official and non-official) for forming a National Farmers' Union to help the Government in its Land Transformation Programme. This is under the consideration of the Government of India.

AGRICULTURAL EDUCATION

Indian Council of Agricultural Education

With a view to co-ordinating agricultural education programmes (including education in animal husbandry and dairying) in the country and to aim at a uniform standard of agricultural education, an Indian Council of Agricultural Education was set up under the

aegis of the Indian Council of Agricultural Research on the recommendation of a Conference of State Ministers for Agriculture, Vice-Chancellors of Universities, Deans of Faculties of Agriculture and Principals of Agricultural Colleges in India, held on 3 and 4 November, 1951.

The Hon'ble Minister for Food and Agriculture is the President of the I.C.A.E. The Vice-Chancellors of Universities having under them colleges imparting education are members. In addition, representation has also been given to agriculture and veterinary colleges and other interests. The Council of Agricultural Education functions through two executive committees—one for agriculture and the other for animal husbandry including dairy science.

The Council will be purely an advisory body and will co-ordinate agricultural education (which term includes animal husbandry and dairying) programmes so that a uniform standard of agricultural education might be achieved throughout the country. It will concern itself with only the broad principles of agricultural education and will advise provincial government on such problems as will be referred to it and it will prepare model syllabuses for adoption in the various teaching institutions concerning agriculture, animal husbandry and dairying.

Sisterhood Relationship between Indian and American Universities

A proposal to establish sisterhood relationship between Indian Universities teaching agriculture and similar Universities in the U.S.A. was accepted by the Government of India. Under this scheme, American Universities would send members of their Faculties to Indian Universities for specific periods on exchange basis and would also give facilities in the U.S.A. for the training of junior members of the staff of Indian Universities.

CROP COMPETITION

In 1949-50 the Government of India introduced a Crop Competition Scheme on a country-wide basis as an aid to increase food production. This scheme was a part of the 'Grow More Food' campaign and was subsidised in terms of the G.M.F. rules. It was thought that stimulating a healthy rivalry among farmers in crop production would tend to increase the yield per acre as competitions will lead to the use of improved methods of farming.

Crop Competition Fortnights

The State Governments were required to organize crop competition fortnights immediately before the *rabi* and *kharif* sowings, the intention being that during this period the agricultural and revenue officials would explain to the farmers the value of these competitions, organize them on a large scale and enlist competitors. The crop competition fortnight for *rabi* sowings is held from 1 to 14

June. During the crop competition fortnight the States give the widest publicity to the crop competition scheme, the prizes awarded for the competitions, the crop selected, the rules regarding the competition and the prizes given to the winners of the competition.

Basis of Competition and Prizes

Under the Crop Competition Scheme prizes are awarded to the farmer who gets the highest yield in a selected crop in the village, *tahsil*, district, State and all-India level. When the scheme was started, only three crops were selected for competition, viz. wheat, paddy and potatoes. During 1951-52 six crops were selected viz. wheat, paddy, potatoes, gram, *jowar* and *bajra*.

Crop competitions are intended to be organised in every village where at least 20 agriculturists would come forward with a demonstration plot of not less than one acre for participating in the crop competitions and agree to pay an entry fee of Rupee 1/- each. In the case of potatoes, the demonstration plot will be of the size of not less than half an acre. There will be separate competitions for *kharif* and *rabi* crops. Prizes will be awarded on a crop-year basis. In every village either the *gram panchayat* or Agricultural Development Committee or the co-operative society will organise the crop competitions. Where no such committee or society exists, a special Crop Competition Committee will be set up. The competitors will intimate to the organising committee the area and the survey number of the particular plot which they wish to offer for competition after one month of the completion of sowing.

Prizes Awarded

There are a number of prizes at the different levels. The prizes for the village and other levels range from Rs. 10 to Rs. 1,000 and vary from State to State. For 1951-52 competitions the Government of India have announced all-India awards of Rs. 5,000 each to the farmers who get the highest yield per acre in the country for paddy, *jowar*, *bajra*, gram and potatoes. For wheat an all-India prize of a tractor costing over Rs. 7,000 has been announced. The all-India prize winners will also be awarded certificates of '*Krishi Pandit*'. A private firm has donated a diesel engine to the all-India prize winner.

Crop Competition Results

While undoubtedly the crop competition scheme is still in its infancy, the results of the crop competition reports received from some of the States show that the scheme is taking firm root. The yield of potatoes in the competition area in the Uttar Pradesh increased in 1949-50 from 250 maunds to 678 maunds per acre unit and wheat registered an increase of as much as 48 maunds per acre. Similarly the yield of paddy in West Bengal in the competition area increased from 15.8 maunds to an average of 33 maunds per acre, the highest yield achieved being 73 maunds.

The yields obtained by the all-India prize winners in 1949-50 and 1950-51 are as follows :

Name of the all-India prize winner	State	Crop	Highest yield per acre	Average yield per acre in the competition area
1949-50				
Shri Jagdish Prakash	U. P.	Wheat	Over 58 md.	
Shri Ratan Prakash	"	Potato	Over 679 md.	
Shri J. C. Pani ..	W. Bengal	Paddy	Over 73 md.	
1950-51				
Shri K. Vellaiya, Gounder	Madras	Paddy	12,000 lbs.	1,900 lb.
Shri Padam Singh	U. P.	Wheat	Over 59 md.	20 md.
Shri Madho Kirpal	"	Potato	Over 726 md.	375 md.

Originally only four States participated but now 22 States are participating in the scheme.

PUBLICATIONS AND PUBLICITY

Indian Farming

The reformed '*Indian Farming*' is now being published from Bombay by Messrs Associated Advertisers and Printers Ltd., who have been appointed as Agents for the journal for a period of one year. With its more attractive format, it is designed to serve the interests of the Indian farmers to a wider extent and carries besides feature articles, topical notes, etc., special interviews with farmers and material for guidance on day-to-day agricultural operations. As against 2,350 copies of the old '*Indian Farming*' about 4,000 copies of the new '*Indian Farming*' are printed and distributed.

Developing Village India

'Developing Village India' is the theme of '*Indian Farming*', Special Number, 1946. The publication was reprinted in response to a persistent demand by Messrs Orient Longmans Ltd., 17-Chittaranjan Avenue, Calcutta-13, under the authority of the I.C.A.R. The publication contains articles of a high standard in a popular language by different experts and an exhaustive bibliography of literature on rural development subjects.

Kheti

No appreciable progress was made in the prompt printing of '*Kheti*'. The printing of '*Kheti*' was transferred to Messrs Coronation Printing Works, Fatehpuri, Delhi, for ensuring regularity in publication.

Scientific Journals

The position regarding the printing of the '*Indian Journal of Veterinary Science and Animal Husbandry*' was comparatively more favourable than the '*Indian Journal of Agricultural Science*'. In March 1952, three issues of the former and six issues of the latter journal were in arrears. Non-adherence to the time schedule by the press assigned for these publications concerned resulted in the journals falling into arrears.

Occasional Publications

A manual on 'Dairying in India' by Prof. J. N. Warner which was prepared under the auspices of the Council was published by Messrs MacMillan and Co., Calcutta. The manual is the only one of its kind so far published in India on the subject.

Monographs and Bulletins

The following publications were issued during the period under review.

1. Scientific Monograph No. 14 entitled 'Further studies on cereal rusts in India, Part I' by K. C. Mehta. (Second edition).
2. Bulletin No. 17 (incorporating Bulletin No. 54) entitled 'A survey of important breeds and types of cattle in India'. (Second edition).
3. Bulletin No. 27 entitled 'Definition of characteristics of seven breeds of cattle of all-India importance'. (Third edition—reprinted).
4. Bulletin No. 46 entitled 'A brief survey of some of the important breeds of cattle in India, Part III'. (Second edition).
5. Bulletin No. 50 entitled 'Reprint on the cardamom cultivation in South India' by W. W. Mayne. (Second revised edition—reprinted)
6. Bulletin No. 70 entitled 'Standard methods for the examination and analysis of milk products other than *ghee*'.
7. Bulletin No. 71 entitled 'San Jose scale in India' by H. S. Pruthi
8. Bulletin No. 72 entitled 'Sample survey for the estimation of yield of food crops'.

A new quarterly periodical entitled '*Statistical Newsletter*' was started. This is intended to cover the activities of the Statistical Section of the Council as also items of news of interest to the Statistical World. Articles of a popular nature explaining the scope and progress of statistical investigations are also included.

Another new periodical was proposed to be started under the name of '*Rice News Teller*'. This would contain current matters of interest and activities of paddy workers in different parts of the country.

A series of reviews was planned. The reviews could contain up-to-date information on various subjects in agriculture and animal husbandry. The series is intended to cover the lacuna left by the conversion of the '*Indian Farming*' into a popular farm magazine which hitherto contained articles of a semi-technical nature useful to field workers. Some of these reviews are already in various stages of printing.

Extension Pamphlets and Leaflets

This series has been planned to put across to the farmer useful results of research schemes sponsored by the Council. Some of the contemplated pamphlets and leaflets have already been prepared and a few are in the press.

CHAPTER II.—AGRICULTURAL RESEARCH

GENERAL

Rice and Wheat Research Workers' Conference

A Conference of Rice and Wheat Research Workers which made a number of recommendations, was held at Coimbatore from 27 to 29 July, 1951. The important recommendations of the conference are detailed below.

1. A ' *Rice News Teller* ' should be issued at quarterly intervals by the Indian Council of Agricultural Research.
2. Two or three experienced scientists working on rice should be sent abroad to study the chemical methods of controlling weeds by the use of weedicides and hormones which have been found to be effective in other countries like England and America.
3. More and more scientists should be deputed to participate in the International Rice Conference of the Food and Agriculture Organisation Meeting as rice holds a key position in the economy of our country.
4. The possibility of growing double crops of rice wherever irrigation facilities were available should be explored and extended with a view to increase the production of this crop.
5. The States where paddy and wheat were important crops should appoint wholetime specialists with necessary staff to intensify work on these food crops.
6. The work connected with the efficiency and use of manures and fertilisers and the soil studies connected therewith as well as that of the placement of fertilisers should be carried out by States where paddy is an important crop.
7. Research on green manuring crops should be undertaken.
8. The Conference drew a plan for breeding, non-lodging, drought, saline and flood-resistant varieties of paddy.

These recommendations were subsequently endorsed at the joint meeting of the Board of Research and Extension held at Coimbatore on 30 and 31 July, 1951. (The recommendations on wheat are given in the section of this chapter on wheat).

Crops and Soils Wing Meeting

The ninth meeting of the Crops and Soils Wing was held at Indore from 20 to 25 March, 1952. In conjunction with this a joint meeting of the Boards of Research and Extension, a seminar of extension workers and a Directors' Conference were also held.

The Wing considered the following subjects and made various recommendations for implementation by the different Governments.

1. A review of the progress of mechanisation in agriculture and its economics, possibilities and potentialities in India, in so far as use of tractors was concerned.
2. A review of the work on water requirements of agricultural crops indicating future lines of research.
3. The scientific manuring of crops in a rotation to build up soil fertility.
4. The role of rural leadership in the development of intensive cultivation.
5. The need of agricultural bias in education and the effective means of its early realisation in the country.
6. The organisation and methods of controlling locust swarms.
7. Review of green manuring methods already adopted and further measures to popularise its use for increasing yield particularly of food crops.
8. A review of the work on the evolution of rust resistant varieties of wheat and the manner in which it can be speeded up.

Two other important subjects considered by the Wing were (1) how to avoid urban bias in rural workers and (2) use of improved seed. On the former subject the following recommendations were made for communication to the State Governments.

1. Future agricultural colleges should be located in rural areas as far as possible.
2. Agricultural graduates, who have no land of their own, should be given land or adequate loans on easy instalments on condition that they purchase land and cultivate it themselves.
3. A plot of land, 1/20 acre or more, should be allotted to each student studying in an agricultural college for raising crops with his own hand and without the aid of bullocks or labour. The produce of the plot would go to the student for meeting his pocket expenses.

4. Frequent transfer of agricultural staff should be avoided. While such transfers may be useful in the case of administrative staff, it is imperative that agricultural staff should spend as long a period as possible in a particular area.

As regards the use of improved seed the Wing recommended that the area under improved seed should be extended with all possible speed, sufficiently attractive premium should be paid for the improved seed and that States should enact without delay a Pure Seed Act.

Co-ordination of Agricultural Research

In accordance with the recommendation of the Governing Body of the Council made at its meeting held in 1950, the State governments, commodity committees and Central institutes submitted to the Council their annual reports and technical programmes of work, for effecting co-ordination of agricultural research, with a view to avoid, as far as possible, unnecessary duplication and overlapping, to effect economy in expenditure and to ensure proper utilisation of the available technical personnel. The remarks of the scientific committees of the Council on these reports and programmes were duly communicated to the States, commodity committees, etc.

During the year under report suitable assistance was provided to some of the newly formed States which had no facilities of their own to tackle their research problems. The various State governments were also requested to initiate work on soil physics on the lines similar to that undertaken by the Government of Bombay, in case work of this nature had not already been done by the States.

A Conference of State Directors of Agriculture, Directors of Agricultural Research Stations and Directors of Central Institutes was convened at Indore in March, 1952 to discuss the possibility of combining research on specific aspects of some crops at selected research stations at present financed by different Bodies to see how far it was practicable to have combined investigations of similar nature under the same staff on more than one crop to start with and whether it would result in reducing any avoidable expenditure of men and money. To achieve this end, it was suggested that when schemes were submitted to commodity committees, details should be given regarding schemes with which the proposed scheme could be combined and failing that a certificate should be appended that there was no scheme with which it could be combined.

The Conference also suggested that the Council should prepare a list of agricultural research stations all over India indicating the crops and experiments handled therein.

It was felt that the Directors' Conference provided a forum for discussing problems concerning more than one State and hence should be continued as a regular feature.

PLANT INTRODUCTION

RICE

India, only second in total production of rice, has the largest area, nearly 70 million acres under this crop. The Indian Council of Agricultural Research since its very inception over 20 years ago had been alive to the importance of this crop in our national economy and sanctioned research schemes in various States to explore ways and means to augment production. This financial help has given a great fillip to rice research and substantial achievements have been made, particularly in breeding new and better yielding varieties.

During the year under report there were 11 schemes in operation in various parts of the country of which seven were on agronomy and breeding, three on pests and diseases and one on manurial experiments. Four new schemes were sanctioned with effect from 1 April, 1952. Two of these will be worked at the Central Rice Research Institute, one for the survey and collection of material from the Jeypore tract of Orissa State which is considered to be a secondary centre of origin of rice in India, and the other for the preparation of a bulletin on the cultural practices of rice. The other two schemes will be worked in the States of Madhya Bharat and Uttar Pradesh. The Madhya Bharat Scheme is for breeding high yielding varieties suitable for the State while the Uttar Pradesh Scheme is for breeding varieties suitable for *usar* (saline) lands of the State.

The principal achievements of the current schemes are as follows.

Chinese varieties. Out of the several introduced varieties of paddy, both Indian and exotic, Chinese is the only one now being grown and multiplied to a great extent in Kashmir. The others such as American, Italian, Australian and Japanese having longer duration are still under trial. The Chinese varieties which have been fully acclimatized by now have given heavy outturn of 55 to 70 maunds per acre, which is much higher than the yield of other imported and indigenous kinds. These varieties have replaced most of the local varieties and have been popular throughout the State. The large-scale spread of these varieties (1039, 988, 1007 Chinese) has already improved the economic condition of the cultivators and solved the food problem of the Valley to a great extent.

The seven leading varieties obtained from the last year's quasi-factorial test were put under comparative strip trial experiment with *Begum* (local highest yielder). In this trial China 1039, China 988, China 972 and China 1007 gave 75.80, 62.49, 58.80 per cent more yield respectively than *Begum*.

The main varieties of China paddy that have been distributed in the State are China 1039, China 1007, China 988 and China 972. Amongst these varieties China 1039 is getting more popular with the cultivators, being well suited for rotation purposes, particularly for their pigmented sheath character combined with high yield, earliness and resistance to *rai* disease.

The outstanding results on acclimatisation of the Chinese varieties in Kashmir have prompted the need to conduct trials in other States also and thus to replace low yielding local varieties in course of time with Chinese varieties. These trials are now in progress in Central Rice Research Institute, Cuttack (Orissa), Assam, Uttar Pradesh and Punjab.

Rice Breeding Station, Nawagam (Bombay). Selections significantly superior to local by 5 to 22 per cent are available in the important local varieties of Kaira district, viz. *Sukhwel*, *Sutarsal*, *Jirasal* and *Ponkhali*; a promising selection in *Kamod* also is on hand. In the yield trials of improved strains from the State of Bombay and outside, conducted for two years, T 22-A, an improved strain of *Bansi* variety from Uttar Pradesh outyielded the local *Jirasal* variety.

Rice Breeding Station, Bulsar (Bombay). In the four principal varieties of Surat district, viz. *White Khada*, *Red Khada*, *Wankheval* and early *Kolam*, selections superior in yield by 13 to 26 per cent over local have been isolated. Early *Kolam* selection No. 161-42 possessing fine grain with lustrous kernel and high yielding capacity, maturing within 95 days is likely to be suitable for growing between cotton crops sown in Gujarat. Yield trials of existing improved strains from Bombay and outside have proved their unsuitability in comparison with the local varieties, thus indicating the potentiality of the local material. The scheme terminated in March 1952 and the final results will be available shortly.

Hyderabad. The yield trials gave statistically significant results. The general mean yield of the trial is 763 lb. per acre which confirms the unfavourable season for the rice crop. *Eshwarakorra* was the last to mature and topped the list with significant superiority over all the other cultures. HR 35 was the lowest in yield due to the severe attack of gall-fly which caused extensive damage mostly due to the delayed transplanting. The two strains HR 42 and Hr 63 which gave high yield during the year are proposed to be tried for another year.

In the manurial treatment, 60 lb. N and 45 lb P_2O_5 gave the maximum yield of 1160 lb. per acre. No appreciable difference could be noticed due to the application of different doses of P_2O_5 .

The scheme has been given an extension till March, 1954 to finalise the results for adoption by cultivators.

Punjab. Out of the 59 rice varieties collected from various parts of the country, preliminary selections have been made. These varieties will be tried this year in comparison with the local Punjab varieties. Amongst the trials with the coarse varieties, S-20 gave an average yield of 23.81 maunds per acre and is considered suitable for being given to the cultivators for large-scale multiplication.

West Bengal. Twenty-three collections of paddy including eight different species of *Oryzae* have been made from different parts of India. The study of their botanical and agronomical characters as well as the isolation of the pure line selections of the promising type is being carried out. Eight Chinese varieties that had been sown both as *aus* and as *aman* showed a greater promise as *aman* than *aus*. Further trials are in progress.

One hundred and five types of *Boro* paddy were collected during the year and their performance is being studied. Nine varieties of real *Boro* paddy collected from Assam, East Bengal and Orissa were multiplied at different centres. Of these, Orissa *Kakuria* has proved to be very successful everywhere giving an average yield of 36 maunds per acre, more than double the yield of the local types. Conclusive results have not yet been obtained from the varietal and cultural experiments conducted under the scheme. Further work is being continued and the scheme has been given an extension till 31 March, 1955.

Coorg. Preliminary selection of promising strains from the three popular varieties of rice grown in Coorg namely *Kiribilya*, *Sannabatta* and *Mainbiliya* were made during the year. Paddy varieties from Madras, Mysore, Bombay, Assam, Bengal, Delhi, Hyderabad and Madhya Pradesh have been collected and maintained for conducting yield trials.

Pests and Diseases of Rice

Madras (Blast and foot rot). The scheme has for its object the investigation of two major diseases of rice occurring in South India, namely blast caused by *Piricularia oryzae* and foot rot caused by *Fusarium moniliforme* Var. *majua*, with special reference to measures for their control. As a result of the work carried out on blast a number of resistant cultures have been selected and of these, two highly resistant cultures possessing a high capacity for yield have been released as Departmental strains Co. 25 and Co. 26 (long duration) which are now rapidly spreading in the main paddy areas in the southern parts of Madras State where during the year nearly one lakh acres were planted with these strains. Work on the selection of short duration resistant varieties is in progress and a few promising cultures have been selected. These, after final tests, will be released if found suitable with regard to their agronomic character and seasonal behaviour. Experiments carried out during the last eight years under the scheme have shown that, in susceptible varieties, the incidence of blast increases with the application of increasing levels of nitrogen, while in the highly resistant varieties like Co. 25, Co. 26 and Co. 4 a very high level of nitrogenous

manuring does not appreciably lower their resistance to the disease. This finding is of practical importance in relation to the attempts to increase rice production by intensive manuring. In susceptible varieties grown in tracts where blast is prevalent, excessive nitrogenous manuring may result in total failure of crop if seasonal conditions favour the development of the disease.

Foot rot has been found to be effectively controlled by treatment of seed with a suitable fungicide. Among the various fungicides tested organo-mercury compounds were found to be the most effective in controlling the disease. Large-scale field trials were carried out and followed up by organised campaigns in tracts where the disease was prevalent. The Plant Protection Staff of the Madras Agricultural Department have included seed treatment of paddy seeds as one of the main activities in the districts of East Godavari, West Godavari, Kistna, Madura and Coimbatore. During the year nearly 50,000 acres were sown with treated seeds. The scheme has been extended till March, 1954 to carry on further investigations.

West Bengal (Helminthosporium disease). Results so far obtained show that nitrogenous fertilisers tend to make the plants more susceptible to the disease while phosphates tend to increase resistance to infection of the pathogen. Spraying is more effective than dusting in reducing infection and Perenox tends to show better effect than Dithane-z-78. Further investigations are being continued.

West Bengal (Insect pests on paddy). As a result of the experiments conducted it was found that the paddy stem borer becomes more active during the first half of the night than in the latter half as also that the catch of this insect appreciably dwindles down during the full moon week as compared to the catch during dark nights. Study of the rice hispa showed that the intensity of its attack varied with the age of the crop in the seedling stage the damage was 1.8 per cent.; in the transplanted paddy (one week after transplantation) 3.1 per cent.; in the flowering stage 23 per cent and nil in the ripe stage of the crop. Experiments were carried out to test the efficacy of the application of different insecticides against rice hispa. In consideration of residual effect, rapidity of action, absence of phytocidal effect and low cost, BHC stands first and DDT stands next. A search for the alternate host plants of stem borer and hispa was made throughout the State of West Bengal. It was found that rice hispa infested on a grass plant *Vetiveria zizanioides*. No new alternate host has been noted for the paddy stem borer. The scheme has been extended till 31 March, 1954.

West Bengal (Manurial experiments on paddy). The scheme is being worked at three places in West Bengal, viz. Chinsura, Suri and Berhampore. At the Chinsura farm no increase in the yield of grain was noted by the application of ammonium sulphate. The grain yield appeared to decrease with the increased doses of ammonium sulphate.

The straw yield, however, increased with the increased doses of ammonium sulphate whereas in the last year both the grain and straw yield were increased by the application of this fertilizer. The adverse effect on the yield of grain during the year may be due to the continuous heavy rainfall during flowering and grain formation periods of rice. The plants in the experimental plots were actually under water at that time. Bonemeal, farmyard manure and lime appeared to have no effect on the yield of grain and straw at Chinsura. At the Suri farm in the experiment with ammonium sulphate, bonemeal and farmyard manure all the manures and fertilisers have shown positive effect on the yields of paddy, grain and straw but the effect of ammonium sulphate was much more remarkable. At this station, lime appeared to have very little effect on the yields of grain and straw. At the Berhampore farm, ammonium sulphate showed appreciable effect on the yield of grain and straw which contradicted the results obtained last year. These experiments are being continued.

WHEAT

The Conference of Rice and Wheat Research Workers and subsequently the Joint Meeting of the Boards of Research and Extension held at Coimbatore in July, 1951 emphasised the national importance and magnitude of the problem of wheat rust and the necessity of intensifying research for controlling it. Proposals to achieve this were considered and approved by the Wheat Rust Control Committee, Local Sub-Committee, Research Board, Advisory Board and the Governing Body of the Council. The scheme comprises :

- (i) extension of the existing scheme which was sanctioned for five years with funds allotted only for a three years' period and
- (ii) intensification of the work both at the Centre and in the States during the same period.

The proposal includes the following salient features.

- (i) Opening of a new Central Station at Wellington in the Nilgiris.
- (ii) The addition of a certain amount of agronomic experimentation at Delhi and Pusa.
- (iii) Opening of centres for breeding rust resistant wheats in the States at Kanpur in Uttar Pradesh, Niphad in Bombay, Prabhani in Hyderabad State and Hoshiarpur in Punjab.

These with the existing centres at Delhi, Simla, Pusa and Indore and the continuation of the two schemes of the Indian Council of Agricultural Research in Bombay and Madhya Pradesh are expected to cover the entire wheat-growing region effectively. Subject to the availability of funds the entire scheme was intended to be put in operation from 1 April, 1952. It will be in full swing after the State centres have been established and a glass house is constructed at the Delhi centre

with light, temperature and humidity control devices, which will enable raising of three generations of wheat in a year thus speeding up the whole work.

Co-ordinated Wheat Rust Control Scheme

Central portion

The co-ordinated wheat rust control scheme which was sanctioned by the Council for the period ending 31 March, 1952, continued functioning during the year under reference at Delhi and Simla Mycological centres and Delhi, Simla, Pusa and Indore Botanical Centre. A resume of the workdone at the existing centres during the year under reference is given below.

Botanical Research

Delhi Centre. The scheme was taken up at Delhi with a view to evolving varieties of wheat, resistant to all the three rusts simultaneously and agronomically suitable for growing in the plains of northern India. A number of hybrid strains evolved at Simla and found resistant to some of the rusts were under observation. Small-scale trials with a few of the black rust resistant strains were laid out for assessing their yielding capacity and other economic qualities under conditions prevailing in the plains. Certain selections from the double cross which was made at Simla for combining resistance to all the three rusts were also under observation in replicated progeny rows. Crosses made between N.P. wheats and some exotic varieties showing high resistance to rusts as well as those between some of the resistant strains evolved at Simla and the exotic varieties, were studied in F_3 , F_4 and F_5 generations in the year under report and selections were made of plants showing resistance and possessing preferable agronomic characters. Some of these selections appeared to be quite promising.

Pusa Centre. The staff under the scheme could not be appointed till February, 1951 and as such very little work could be done during the year under report.

Certain selections from the cross, Cobo $\times$ N.P. 52 and from the double cross, W. 375 were under observation for making further selections under conditions prevailing at Pusa.

A small-scale trial was laid out the some rust-resistant strains evolved at Delhi and Simla for assessing their yielding capacity, rust-resistance and other agronomic qualities.

Simla Centre. The work at this centre aimed at breeding rust-resistant varieties of wheat suitable for hilly areas. The first stage of the work, which aimed at breeding varieties resistant to all the three rusts individually, has already been achieved. The second stage consisted in an attempt at building up simultaneously resistance to all the three rusts by synthesizing varieties from the material resistant to each rust. Some of the strains were found to have simultaneously partial

resistance to other rusts besides the one to which they were originally bred. Tests with 14 of such varieties were conducted at the Experimental Station. After testing the breeding material available at Simla, it is hoped that better yielding varieties of good quality wheats which are resistant to the attack of rusts, will very soon be placed at the disposal of the farmers in the hills.

Indore Centre. The first sowing was done in October 1951 and the results will be communicated in the next report.

Mycological Research

During the year under report, a total number of 112 field collections from different places was analysed, 90 from 1949-50 crop and 22 from 1950-51 crop. No new race of any of the rusts was met with.

Black rust. Only four races previously reported namely 21, 34, 40 and 42 were found.

Brown rust. All the races previously reported, namely 20, 63, 106, 108 and 'D' were found.

All the single spore cultures were tested on their respective differential hosts twice during the year in the case of black and brown rusts and once in the case of yellow rust. All the cultures are maintaining their purity and no case of mutation in pathogenicity has so far been observed, although one of them had completed 298 generations and others had been grown for over 20 generations by the end of June 1951.

Rust collections on grasses received from different parts of the country were tested on wheat, barley and oat to determine their nature and pathogenicity. During the period under report, rust collections on three grasses and one wild barley infected in nature were received. Collections on grass *Andropogon* sp. from Orissa was identified as *Puccinia graminis tritici* and yielded race 34. Collections on other two grasses, namely *Bromus catharticus* and *Bromus japonicus* and wild barley *Hordeum murinum* from Delhi identified as *Puccinia glumarum*. Physiologic races occurring in these have, however, not yet been determined. A thorough search for infected grasses from different zones would be made for the determination of collateral hosts in the country.

States Portion

Wheat Rust Scheme for Peninsular India (Bombay)

A. *Seedling and mature plant resistance tests of fixed varieties.* Twenty-two foreign varieties, mostly from Australia, were retested during the year. Only five of them, viz. K.G.P.F. 4508, 1521, 4652, 4676 and E. 845 showed a high degree of resistance to the Indian races of stem rust except race 15 to which their resistance is not satisfactory. Seven out of nine rust-resistant strains received from the Indian Agricultural Research Institute were resistant in mature-plant stage although, except strain 88, they were susceptible to some races in seedling stage.

Strain 88 is, however, highly resistant to or immune from all the commonly occurring races and was almost free from infection in the field.

B. *Exotic varieties received from the Economic Botanist to the Government of Bombay, Poona.* Of the fifteen exotic varieties retested during the year 1.36.32.13.2.1.2 is resistant in the seedling and adult stages while two H.R. Spring types and Lumillo, though susceptible in the seedling stage, exhibit a high degree of mature-plant resistance.

Mature-plant resistance tests of hybrids. Progeny of 35 crosses in F_1 and F_2 included back crosses and out crosses. The rust-resistant parent in many of these crosses is Gaza (*T. durum*) while the rust-susceptible parents were Bansi 168, Gulab, Jaya and Baxi selections. These crosses have been made with the object of developing rust-resistant *durum* varieties for Bombay State. On the whole, the reaction of F_1 plants to stem rust was towards the susceptible side, although no definite conclusion could be drawn on account of the too small a number of plants under test.

Of the crosses in F_3 , selections from Mondhya 3-2 $\times$ E. 144 seem to be promising for agronomic characters.

Preliminary yield trials have indicated that the selections from Kenya E. 144 $\times$ Niphad 4 yield 15-20 per cent higher than the local improved rust-susceptible varieties grown under irrigation. Seed for about 2000 acres is now available and the Deputy Director of Agriculture (Crop Research) proposes to conduct yield trials in cultivators' fields next year.

Madhya Pradesh Section

Seedling and mature-plant resistance tests of fixed varieties. Of the Australian varieties, E. 839 is semi-resistant but ranks below E. 220 in point of resistance. Other Australian varieties, viz. E. 822, E. 823, E. 824, E. 825, E. 831, E. 832 and E. 833 are highly susceptible. Six strains of W. 245, viz. strain 125 strain 126, 33-8/8-7-5, 8-8-16 and 8-8-18 possess resistance like that of E. 220.

Mature-plant resistance tests of hybrids. Promising rust-resistant lines have been obtained from the following crosses in F_1 , 4, and F_2 , 5; Ex. 117 (Kendee) $\times$ N.P. 114-3-2, Ex 11 (60 B-12B-16L) $\times$ N.P., 114-3-2, E.B. 14 $\times$ Ex. 73 (C. 14112), E.B. 76 $\times$ Ex. 73 and A. 113 $\times$ Ex. 73. Some of these lines have proved homozygous for rust-resistance in F_1 as well as in F_2 .

According to information supplied by the Wheat Specialist, I/C Wheat Research Scheme, Hoshangabad, 21 rust-resistant strains from different crosses are under multiplication and the seed is now available for about 530 acres. These strains consist of very early, medium late and very late ones according to their suitability for different tracts of Madhya Pradesh.

Wheat Rust Research Scheme in Madhya Pradesh. Fresh seed samples of *durum* strains, Gaza RL 1664 and Mindum x Carlaton RL 1754 were obtained from Canada and grown during the year, and compared with the samples received previously. Five strains of W 245, viz., 123, 126, 33-8-8-7-8, 33-8-8-8-16, and 33-8-8-8-8 received from the Head of Division of Botany, I.A.R.I., New Delhi, for field trial, were on testing at Mahabaleshwar found to be resistant.

Some of the true breeding hybrids, whose seed was sufficient for the purpose, were compared with local strains for yield in replicated trials at Powarkheda, Chhindwara, Adhartal (Jabalpur), Tharsa (Nagpur) and Washim (Berar) farms.

Multiplication of seed of the true breeding hybrids. Twenty hybrids, six from the three crosses in F_3 generation and 14 from the five crosses in F_7 were multiplied over an area of about 42 acres of which seven acres could be irrigated from a well. The total quantity of seed obtained from these hybrids is 43,718 lb. which is being supplied to Government farms for trial and multiplication.

MAIZE

Maize is an important food and a fodder crop. The earlier line of work of improving this crop by selection and breeding has now given way to the production of hybrids for exploiting the hybrid maize suited to different areas. For this purpose the Council is financing schemes at the I.A.R.I., Punjab, U.P., Bihar, Hyderabad, Rajasthan and PEPSU. The I.A.R.I. work is mostly of a fundamental type, the main object being to facilitate the production of hybrid maize in an efficient manner. The work at other centres is concentrated on producing hybrids suited to their areas. The results of the work during the year are given below.

Indian Agricultural Research Institute

Trials with Indian and foreign varieties. Out of 82 Indian and foreign open pollinated varieties tested, great variation was found with regard to (a) plant height (which ranged from 45-80 in.), (b) days to silking (particularly in Indian varieties which ranged from 50 days in *Tidki* to 85 days in Chittagong variety) and (c) ear length (from 7.6 in. in Pb. 22 to 4.4 in. in *Vijapuram*). However, Bidar (Au) gave the highest yield (about $9\frac{1}{2}$ maunds per acre) while Chittagong gave the poorest (about $1\frac{1}{4}$ maunds per acre).

Trials with foreign hybrids. A number of U.S. hybrids received from the F.A.O. and the U.S.D.A. were tried in 17 centres. In most of the centres some of the U.S.A. hybrids gave higher yields than the locals—the extra yield ranging from 12.68 per cent in Kulu (Punjab) to 131.37 per cent at Nagpur (Madhya Pradesh). As regards maturity many of the high yielders matured in a time nearly equal to or slightly more than that of the respective local varieties. Those

hybrids which are early in maturity have given poor yields. On the whole Dixie 11 was among the top five at nine locations, U.S. 13 at six locations and Dixie 18, N.C. 27 and Indiana 252A at five locations. These trials are being repeated to get confirmatory results. The indications, however, are that the U.S. hybrids have definitely a superior yielding capacity under certain Indian conditions. (Seeds of US 13 are being multiplied in India under a scheme financed by the Council at Almora. Details are given at the proper place).

As to the Canadian and Australian hybrids, the latter also yielded better than the locals while the Canadian hybrids were not found to be good yielders probably due to their very early maturity.

Materials obtained from the United Hybrid Growers Association were tried at three centres. They gave higher yields than the controls and in some cases even better than the U.S.A. hybrids. Their closed pedigree, however, is a serious drawback in their wider utilisation as commercial material in this country.

Studies on selfing and sibmating. During the year, 48 pairs of selfed and sibbed lines were studied. In general, the sibbed lines were better in such characters like plant height, ear length, number of good cobs per plant, etc. though in some isolated cases the selfed lines were better than corresponding sibbed ones with respect to particular characters.

Out of the 700 inbred lines raised so far, 200 have been selected for trial in the next season. New inbred lines were also started by selfing promising Indian and foreign varieties. About 200 top crosses were made with selfed and sibbed lines, etc. so far. About 170 crosses between various inbreds were also made for testing their performance in single crosses.

Trials with the pollens of other plants (such as *bajra*, *baru*, *setaria*, etc.) for pollinating silks of maize were conducted with inconclusive results. Germinating seeds and coleoptiles of young seedlings were treated with various doses of colchicine in order to study its effects, but no definite conclusions could be arrived at.

Punjab

Inbreeding occupied an important place in the programme of work. Out of the total collections and selfings made so far, 1682 plants were sown at Jullundur, Kulu and Nagrota. The effect of successive selfing on the homozygosity and vigour of the resultant progenies was studied by working out the coefficient of variability in the characters such as tasseling period, height of plant, length of cobs, 100 grain weight and grain yield per plant. As the idea behind the hybrid corn method of breeding is that lines which have attained the desired degree of purity in respect of all the above characters should be obtained and

made use of in making cross combinations, search was made in the available material in various selfing generations of such inbred lines as may have obtained a low coefficient of variability in all the major character. This showed that some of the inbred lines had reached the stage of reasonable purity in respect of all the plant characters after, 3rd, 4th and 5th generation of selfing. All such inbred lines which have obtained sufficient purity in all the plant characters, will be tested for their combining ability so that single, three way or double crosses could be made subsequently between the lines exhibiting high combining ability.

Studies on cross combinations. After obtaining homozygous inbred lines, the next step in the development of hybrid corn, is the determination of the most productive cross combination which could be finally given out to the maize growers. As such a number of crosses (top crosses, single crosses and double crosses) made during the *kharif* of 1940 were tested for potentialities.

(a) *Top crosses.* Preliminary trials were made with inbred lines in top crosses to find their general combining ability to attempt crosses on a planned basis. During the *kharif* of 1950 in all 81 top crosses including four reciprocals were under test at Jullundur, Kulu and Nagrota. Of these only 10 gave significantly higher yields at Jullundur than Jullundur locals and four at Kulu. These lines will be utilised for hilly tract in Kangra district. Fresh top crosses (numbering 181) were also made during the *kharif* of 1950.

(b) *Single crosses.* Though the usual procedure is to attempt single crosses only after the relative general combining ability of various inbred lines is known from their behaviour in top crosses, (so that such crosses are made between the best lines), it was considered expedient to attempt single crosses between such lines as appeared to be reasonably uniform, with a view to save time and achieve quick results. In all 201 single crosses were tried. These did not, however, give such a good performance as was expected of them. These crosses were not, however, made on any planned basis, i.e. before judging the actual combining ability of the inbred lines. The fresh crosses which are being made on a planned basis will be tried next season.

(c) *Double crosses.* As double crosses are more remunerative than single crosses for raising commercial crops, 21 double crosses attempted between such single crosses as appeared vigorous in growth during *kharif* of 1949 were tested in 1950. None was found to be of any economic value, though three showed slight tendency for superior yield. Further search is being made for better and more high-yielding cross combinations.

Trials with foreign hybrids. U.S. hybrids did well at all places excepting Mangowal; 10 out-yielded the best locals at Jullundur, 13 at Nagrota and three in Kulu. Only Iowa 4417 was significantly superior

to local at Jullundur, and N.C. 27 and Dixie 11 at Nagrota. Also SC. 14 (hybrid from Egypt) outyielded the best local at Jullundur significantly. Two Australian hybrids (Q. 739 and G.H. 134), however, gave a significantly higher yield than the best locals at Kulu.

Investigations and trials have indicated the possibility of maturing two crops of maize in a year (early spring crop in hills which will mature in July and then supply material for raising a summer crop in the plains in July-August). This would go a long way in expediting the maize breeding work.

Uttar Pradesh

The scheme was started in 1949 and is now in its third year.

On an average 65.3 per cent success in selfing has been secured in maize under Kanpur conditions.

In the trial with double hybrid U.S. 13 and Iowa 306 against T. 41 and two unselected locals of Farrukhabad and Kalianpur, Farrukhabad local yielded significantly higher (1043 lb.) than U.S. 13 (612 lb.) and Iowa 306 (383 lb.) as in last year.

In trials with 36 double hybrids imported from the U.S.A. against T. 41 and five locals of U.P. at Bahraich, T. 41 yielded significantly higher (2087 lb.) than US hybrids, the highest of which, viz. Ohio K. 24 yielded only 1949 lb. Likewise in trials with nine Australian and Canadian hybrids against T. 41 and six locals of U.P. at Bahraich, T. 41 again yielded significantly the highest (2300 lb.) the next best was DC. 355 which yielded only 1670 lb. per acre.

To test the decline in vigour and yield of S_1 types when a trial with five varieties was carried out, as was expected, open pollinated of all types yielded higher than their S_2 types. Out of these T. 41 open pollinated yielded significantly higher than the rest.

West Bengal

Of the 200 local and foreign collections of maize varieties a few anatomical studies have been selected. Morphological, physiological anatomical studies of these varieties are being carried out. Among the 36 U.S.A. hybrid maize put under trial, nine requested increase over the best local. Of these Dixie 18 has yielded the highest (3126 lb. per acre). Further trials are in progress.

Hyderabad, Bihar, Rajasthan and PEPSU

The schemes have started only recently at these centres.

Sweet corn in the Punjab. Seeds of foreign varieties have since been received and the schemes will start functioning shortly.

New Schemes

Earlier experiments had indicated the superiority of U.S. 13 (a double cross hybrid) over the local for certain areas in U.P. A scheme

was therefore, sanctioned for the production of 100 maunds of U.S. 13 at the Vivekananda Laboratory, Almora. The seeds have been produced and will be distributed for sowing in the next season in Government farms and cultivators' fields both in the plains and hills to find out their suitability and adaptability for different areas.

Another scheme has also been sanctioned at Almora for fundamental work on maize breeding.

MILLETS

Schemes for the improvement of larger millets were in operation in Madras, U.P., Mysore and Saurashtra. The two Madras schemes were for the production and distribution of hybrid *bajra* and for investigation on the striga attack on *sorghum* respectively. The former scheme which was due to terminate in March 1952 has been extended for a further period of five years. The U.P. and Mysore schemes, which were for the improvement of other millets terminated in March 1952. The Saurashtra scheme has started only recently. The results achieved during the year are given below cropwise.

Jowar (Andropogon sorghum)

Jowar or *sorghum*, the second important millet crop in the Madras State was attacked by a root parasite called striga throughout the Madras State. The damage in some cases extended upto 75 per cent depending upon the conditions favourable to the growth of the parasitic weed. The loss in *sorghum* grain was estimated at several lakhs of rupees. The problem was worked out in the Bombay State from 1938 to 1948. So far no variety resistant to striga has been evolved. The problem in Madras necessitated a separate investigation on different lines with the object of building up homozygous strains of *sorghum* (from the locals) resistant to this parasitic weed. The work was conducted in four centres; Coimbatore, Nandyal, Bellary (Hagan) and Guntur (Lam). Trials were conducted in striga-infected plots to evolve striga-resistant types—with *periamanjah* selections collected from ryots' fields at Coimbatore, *Patcha Jona* selection from ryots' fields at Nandyal, selections from ryots' fields at Hagari and derivative of crosses between N. 1 and A.S. 4003 and T. 6 and A.S. 4003 at Guntur. Selections showing a high degree of striga resistance were taken for further trials. Before taking up the agronomical experiments on soil treatments with chemicals, preliminary experiments have been started in all the four centres regarding effective and economical doses to be adopted in the use of fernoxone and lime and safe margin of interval to be allowed between the time of application of the chemical to the soil and the sowing of the *Jouna* crop.

Bajra or *Cumbu* (Pennisetum typhoides)

The Hybrid Cumbu Scheme, Madras, has been in operation since 1950.

Hybridisation and inbreeding. Twenty-two new crosses were effected between promising inbreds of medium duration and 20 hybrids were obtained by crossing superior short duration selections with the short duration strain from Co. 3.

Inbreeding was in S_4 and S_5 generations. In addition 33 selections taken from district samples were also inbred for two seasons and their S_2 progenies raised for further selections and inbreeding. It was, however, found that all the cultures did not respond to inbreeding in a similar way, some were reduced in vigour and size while others continued to maintain the vigour met within the outcrossed sibs.

Trials at experimental station, Coimbatore. In the test of the hybrids at the Millet Breeding Station, Coimbatore, in the short duration (75-80 days) group, out of the five tested in summer, only two gave 6 per cent increased yield of grain over the standard. In the monsoon trials, however, selection P.T. 833 (*kallan cumbu* of Madurai) gave 17 per cent increased yield over the control in grain yield. Out of the 13 hybrids of medium duration (90 days) eight seemed to be superior to their parents and standard in their yielding capacity. The hybrids in which K_1 figured as a parent showed marked difference in performance in two seasons; in irrigated season they gave lower yield than the standard Co.1, but higher under rain-fed conditions. It was also observed that Co.2 of Coimbatore and the Anakapalle strains combine well with K_1 and increased yields are obtained from the hybrids. The hybrids in which the latter (K_1) was used as one of the parents were generally longer than Co.1, but shorter than K_1 in duration.

District trials. The performance of the hybrids X.1 and X.2 in the districts of Tirunelveli, Madurai and Sirkakulam was very encouraging, the increase over the locals ranging from 25 per cent in Madurai to 189 per cent in Sirkakulam. The seeds of the hybrids have been distributed to the districts of Sirkakulam, West Godavari, Tanjore, Tirunelveli, Madurai, Tirunelveli and Coimbatore for fresh trials and confirmation of previous performances. Increase in grain yield over the respective locals in different district trials during the current year is given below :—

Location of trials	X.1	X.2
	%	%
Vizagapatnam (Sirkakulam)	189	97
Madurai	67-138	25-39
Tinnevely (Koilpatti)	72-108	92-135

Seed Multiplication and Distribution

Seed farms were arranged in the fields of the cultivators round about Coimbatore for the multiplication of seeds of both the parent

and the hybrids. More than 400 acres were sown in Coimbatore district alone. From the seed raised under irrigation in Coimbatore district, 30,846 lb. of hybrids and parents were procured for distribution. Seeds of parents and other high yielding selections were also multiplied under controlled conditions at the Millet Breeding Station, Coimbatore and 39,912 lb. of seeds were distributed for large-scale growing and also for seed farms. Seed farms were also arranged in North and South Arcot, Salem, Tiruchirapalli, Madurai and Ramnathpuram. Seeds were sent for opening fresh seed farms in other districts also. The total area of seed farms was over two acres.

Finger Millet (Ragi or Mandua) *Eleusine coracana*

In U.P. (1950-51) at Tarikhet centre, 140 strains of *mandua* were maintained. The flowering period of these varied from 96 to 112 days. The improved types H. 67 and H. 104A showed their superiority once again. In the mixed cropping experiments (as is usual in the hills) the mixture of *ragi* and horse gram yielded the highest (of about $9\frac{1}{4}$ maunds grain per acre) the mixture of the soyabean closely following it (with about eight maunds per acre).

Kodon (*Paspalum scrobiculatum*)

In U.P. (1950-51) at Gorakhpur centre, 23 cultures were maintained, the flowering and maturity period varying from 36-54 days and 56-76 days respectively. In the varietal trial, strain 15A/1 gave significantly the highest yield of about 13 maunds of grain per acre against ten maunds per acre of the local. Likewise at Kanpur, strains 14B/1 and 8A/1 gave very good yields of more than 12 md. and 8 md. per acre respectively.

Sawan (*Panicum crusgalli*)

In U.P. (1950-51) at Gorakhpur centre 66 cultures were grown for study and the flowering and maturity periods of the strains ranged from 36-54 days and 67-76 days respectively. At Kanpur centre, two strains (T. 33 and T. 46) were found to be outstanding in their yield of more than nine maunds per acre. In an experiment to find out the most suitable date of sowing for *sawan* to get the maximum yield, it was found to be the third week of June. Type 46 in the second sowing (i.e. on June 20) gave 24 maunds per acre and took less than $2\frac{1}{2}$ months to ripen; the yield was quite commendable for such a short duration crop.

PULSES

Pulses and beans form an important group of plants supplying proteins in the otherwise predominantly carbohydrate diet of a large section of the vegetarian population of our country. They also provide nutritious fodders for the livestock besides being important green manure crops. Co-ordinated scheme has been financed by the Council for a sufficiently long time in important pulse-growing tracts of the

country. Many schemes have terminated and those in operation were in U.P., Madras, Hyderabad, West Bengal, Gwalior, Orissa and the Punjab. A resume of achievements made during 1950-51 is given below.

Botanical Investigations

Bengal gram (*Cicer arietinum*). Next to wheat, gram is the most important crop of the Punjab State, occupying about three million acres in the State; 85 per cent of the total area under the crop is grown under purely *barani* (rainfed) conditions. The chief trouble of the gram crop in the *barani* tract is the wilt disease which causes considerable loss to the crop. Investigations have been proceeding in the Punjab since 1947 for devising control measures. Some interesting results have been obtained. According to the workers the disease is not caused by a fungus and that it could be controlled considerably by cultivation and cropping methods. The scheme has been given an extension till June 1954 to finalise the methods and to try them in cultivators' fields in the wilt affected districts of Ferozepore, Rohtak, Hissar and Gurgaon.

In Bombay State (during 1950-51) out of the 48 selections of the previous year, three were found at Dharwar to possess high (over 77 per cent) resistance to wilt combined with high yield, much better than the Departmental strain *Chafa*. Two strains were found to be promising at Karad also.

In Hyderabad State (1950-51) in the preliminary yield tests at Raichur, seven strains showed increased yield over the local ranging from about 12 to 22 per cent. Likewise in Madhya Bharat (1950-51) Bijapur-3 and *Bhind* were found to be outstanding, yielding more than 10 maunds while at Ujjain, Chanderi-24 was found best.

In Uttar Pradesh (1950-51), out of the 300 strains maintained, a third was found to be high yielding (more than 24 md.) at Kanpur, their duration was 36-125 days to flower; Type 87, however, still remained as the best quality evolved so far having $1\frac{1}{2}$ times the size of the commercial variety. About 8,60,000 lb. of its seed was distributed. Hybridisation was taken up to synthesise progenies with better qualities; production of good quality *kabuli* grams (with large white seeded grains for vegetable purpose) was also attempted.

Red gram (*Cajanus cajan*). In Assam (1946-51) as a result of five years' work at Kohilmukh, 104 pure lines of red gram have been isolated and studied.

In Bombay (1950-51) four selections were found to be outstanding at Arbhavi combining high yielding capacity and resistance to wilt. The best among these (i.e. F. 52) yielded more than 12 md. per acre and was multiplied for distribution.

In Bengal (1950-51) out of the four years collections and selections (done at Berhampore), 46 types have been isolated. Promising strains from these were multiplied at Berhampore, Chinsurah and Midnapore Agricultural Farms, with a view to large-scale trials in the following year.

In Hyderabad State (1950-51) two selections (Yadgir No. 3 and C-11) from new materials showed promise of wilt resistance at Raichur.

In Madhya Bharat (1950-51) types Gwalior-7 and Kachrod-7 showed promise at Gwalior.

In Uttar Pradesh (1950-51) type 17 was found to be superior for high yield, good taste and moderate wilt resistance at Kanpur. Its multiplication was continued.

In Madras scheme (1950-51) culture No. 37, released from Coimbatore, consistently gave the best yield (of about 10 md.). It has been giving the highest yield in Dharmapuri too and has been tried under royts' field conditions in nine centres in three districts where it gave higher yields than the local variety. The long duration variety 97 gave equally good yield—more than 10 md. per acre which was about 14.9 per cent more than the local bulk at Vizianagram.

Green gram (*Phaseolus aureus*). In Assam (1946-51), 82 pure lines were isolated and studied at Kohilmukh, out of which eight strains were found promising. Amongst these Mk-51 has been selected for multiplication.

In Bombay (1950-51) some promising selections (such as Jalagaon 310) were expected from Jalagaon; four selections (Jal. 23,310, *savada* and local 20-5) have proved significantly superior to the locals in the preliminary tests. Among the China *mung* varieties, No. 42 was found to be significantly superior to local. Trial of exotic types in Bengal (1950-51) showed that all the three were superior to locals in growth and yield at Berhampore and among these the late types (EC 776 and 969) were better than type EC 988.

In Orissa (1949-50) selection 150 was found to be outstanding at Athgarh as in previous years followed by type 28. Both were spreading types, the former early, while type 28 was medium in maturity. Likewise at Bargarh, selection 676 gave significantly the best yield as in previous years.

In Madhya Bharat (1950-51) Krishna-11 at Gwalior and Bhilsa green-15 at Ujjain were found promising.

In Madras (1950-51) culture No. 62 was found to be outstanding at Coimbatore as in previous years (yielding about five maunds per acre), i.e. 29.5 per cent more over local bulk. Trial under cultivators' conditions in two *talukas* of Thiruchirapally gave 12.5 per cent more than locals. At Vizianagaram, culture 127 proved its superiority once again by yielding (about six maunds per acre) 30.7 per cent more than the local variety.

In U.P. (1950-51) at Kanpur, selections from the early maturing type 1 was attempted. At Attrah, the best yields were from type 1 and from an early Hyderabad strain.

Black gram (*Phaseolus mungo*). In Assam (1946-51) 102 pure lines have been studied at Kokilmukh; as a result of five years' investigations 15 types have been found promising, out of which a few (like Mk 4, 14, 18, 25, 30, 80 and 81) were selected for consistently better yield.

In Bombay (1950-51) three selections (Dhohad 5/2, Dhohad 3-2 and Jali-1) were found to be significantly superior to local strains at Jalagaon.

In Orissa (1950-51) type S. 1601 was constantly found to be the best at Athgarh, yielding 12 md. per acre. It was better in yield than Pusa types and was a spreading and highly branched medium maturing variety. At Bargarh, five selections (28, 81, 445, 460 and 462) did significantly better than the control; also Athagarh selection 1601 which incidentally seems to do well as *kharif* pulse also at Bargarh.

In Madhya Bharat (1950-51) Morena 2 and Sheopur 17 (at Gwalior) and Jora 4 and Bhilsa black 5 (at Ujjain centre showed promise.

In Madras State (1950-51) cultures 212 and 216 proved once again significantly superior to locals at Coimbatore, more than double of the bulk. At Vizianagaram No. 189 which gave consistently higher yield in previous years, proved its merit by giving 59.6 per cent more than the local bulk.

In U.P. (1950-51) at Kanpur two green-seeded strains and two black-seeded strains gave indications of being possible future types for eastern and western districts respectively.

Matki (*Phaseolus aconitifolius*). In Bombay (1950-51) two types (Dhulia 3-5 and Jagudan 9-4) were found to be the best at Karad, as in previous years.

In U.P. (1950-51) nine selections were found promising at Kanpur.

Horsegram (*Dolichos biflorus*). In Bombay State 1950-51) three selections were found best at Dharwar; four selections (Co. 1, Belgaum 1 etc., Hybd.A and Bijapur, etc.) given out for district trials confirmed the results obtained at Dharwar, out-yielding the locals.

In Orissa (1950-51) improved types (such as S. 27, 38, 39, Lss 103) showed promise at Athgarh and a few (such as No. 40, 47, 137 and 143) at Bagharh too.

In Hyderabad State (1950-51) as a result of three years' work at Warangal, strains 33, 34 and 42 were found to be superior to the locals.

In Madras State (1950-51) at Dharmapuri, cultures 122 and 123 were found to give significantly higher yields (100 and 52.5 per cent respectively) than the local variety.

Fieldbeans (*Dolichos lablab*). In Madras (1950-51) the black seeded No. 1458 gave the highest yield of about $5\frac{1}{2}$ maunds per acre (double that of the departmental strains) at Coimbatore while culture 44 gave significantly higher yields of 45 per cent more than the local bulk at Dharmapuri.

Lentil (*Ervum lens*). Study of the lentil selections in U.P. (1950-51) at Kanpur showed that the duration of flowering varied from 7 to $12\frac{1}{2}$ weeks. The best strain so far appeared to be No. 4303-21 which flowers about four weeks earlier than NP 11 and NP 47. In varietal trials it gave 35 per cent more over the local variety by yielding about $15\frac{1}{2}$ md. per acre.

Peas (*Pisum sativum* and *Parvense*). In U.P. (1950-51) at Kanpur, about 162 selections were made and grouped as (1) table peas—44 (2) white peas—70 and (3) *desi* peas—44. In table peas types 18 and 19 were found promising. Due to the consistently good performance of white peas (4218B-2) in field trials (yielding about $38\frac{1}{4}$ md. dry seeds per acre) it was released as 163. Compared to the local varieties it yielded 35 per cent more. 13,580 lb. of this seed were distributed. In *desi* varieties the flowering duration varied from 7-15 weeks. The best yield, however, were from white peas. Though not of remarkable yielding capacity, they were preferred to others in areas subject to bird damage, which did not find these as palatable as other pea varieties. Attempt was also made to evolve suitable types (with ability to do well in late plantings in hard poorly cultivated clay soils without irrigation) for late paddy pea rotations.

Soyabean (*Glycine soja*). In U.P. (1950-51) among the *khari* pulses soyabean could hardly be excelled by others in grain yield, as well as, in the case of harvesting and threshing. Due to high yield and possible increase in its demand in the near future, more attention was paid to this crop than was originally done.

At Tariket, (near Almorah at 5,000 ft. elevation in the Himalayas) work was carried on to find out a variety which would be early enough to make a soyabean-wheat rotation possible, yet fair enough in yield as compared to local variety to be acceptable to the growers. Exotic selections as well as those from higher altitudes which ripen in 90 days appeared to have possibilities in this direction. Of the 64 strains grown a dozen are early enough for the purpose and greater attention would henceforth be paid to them in order to select the best strains. 111 strains were maintained at Kanpur; the flowering duration varied from 37 to 94 days; ripening 3 to 5 months, seed weight and size from 779 to 149

per ounce. Habit of growth was erect, bushy and intermediate. Grain yields were found to be higher in the medium and late than in early strains.

In Bengal (1950-51) soyabean is an unimportant crop and there is only a limited demand for it in the State. However, from the inter-State collections, it was found that three strains (early C. 23, late Baramali and K-16) were promising at Berhampore.

Agronomic Investigations

Sowing time and seed rate. Two years' trials with black and green gram at Kokilmukh (Assam 1946-51) showed that under the local conditions optimum yields could be secured if they were sown during the months of August and upto the first part of September. Different seed rates (of 4, 6, 8 and 10 seers per acre), however, did not show any significant difference in yield.

In Bengal (1950-51) investigations on the best time of sowing red gram at Berhampore, showed that May and June sowings were the best as regards growth and yield of plants, while July-August sowings gave the poorest yields. In the case of soyabeans, sowing from 19 May to 18 June was found to be best suited for both early and late types.

Mixed cropping. In the Orissa scheme (1950-51) in the mixed cropping experiment at Bargarh with broadcast *beali* (very early autumn) paddy and broadcast black gram, the mixture of 60 and 15 lb. of the former and black gram was found to be the best followed by paddy and pulse at 80 and 20 lb., even a mixture of 80 and 15 was better than paddy or pulse alone as in previous years. The practice was advantageous in many ways; against a pure crop of paddy the advantage was 151.3 per cent more and against pure pulse it was 171.6 per cent. Thus mixed cropping of paddy and pulse (black gram) was more paying than cropping either of them alone. This confirms the results of previous years.

Investigations in Hyderabad (1950-51) on the relative economics of growing red gram alone as compared to a mixed crop in association with *jowar* or groundnut at Warrangal showed that four rows of *jowar* and one row of red gram gave the highest income per acre (Rs. 162-8-0) as compared to red gram alone (Rs. 38). Even a pure crop of groundnut did not yield as much. The better income could, however, be explained by the fact that the price of *jowar* fodder was abnormally high which may probably be partly responsible for the higher money returns in the treatment where *jowar* participated.

In Madhya Bharat (1950-51) in the mixed cropping experiment at Gwalior proportion of 72 : 7 : 21 of *jowar*, red gram and green gram gave the maximum monetary return of about Rs. 93 per acre against Rs. 40 from pure *jowar*. A parallel experiment at Ujjain on

the other hand showed that 64 : 9 : 27 proportion gave the maximum monetary return of Rs. 70 per acre against Rs. 57 per acre from a pure crop of *jowar*. In the cereal-legume mixture, barley and gram grown in the proportion of 90 : 10 at Gwalior gave the highest monetary return of about Rs. 120 per acre against Rs. 68 from a pure crop of barley. The oilseed legume mixture (of rape and gram) in the proportion of 70 : 30 gave the best return of about Rs. 121 against Rs. 95 from a pure crop of rape. Investigations at Ujjain with linseed gram mixture, showed that pure linseed gave the best returns than with different proportions of gram. As to the most suitable proportion in which cereals, oilseeds and legumes should be grown as mixed crops proportion of barley, rape and gram 70 : 15 : 15 gave the highest monetary returns of about Rs. 121 against pure crops of these which yielded Rs. 79, 31 and 40 respectively at Gwalior. Similarly in trials at Ujjain with wheat linseed and gram in different proportions, pure wheat gave the maximum return of Rs. 204 per acre against Rs. 181 and Rs. 102 for pure crops of linseed and gram respectively.

Weeding and ploughing. In Assam, at Kokilmukh (1946-51) one year's trial showed one weeding in black gram gave 20.7 per cent more yield than no weeding. It was also found to be remunerative. There was, however, no difference in effect between two and four ploughings.

Manurial experiments. In Assam, at Kokilmukh (1950-51) application of cowdung (at 100 maunds per acre) was effective in growing black gram after *ahu*.

Processing and preparation. In Madras State (1950-51) investigations on the preparation of red gram *dhal* for market at Vizianagaram, the grain was treated in 11 different ways by soaking in brackish and sweet water for different periods and smearing with red earth for conversion into *dhal*; it was however, observed that there was no appreciable difference in the preparation of *dhal*, time taken for cooking, expansion on cooking or protein content of *dhal*, due to the various treatments.

OTHER CROPS

Cardamom (Madras)

The entomological problems have been nearly solved and the control measures are being recommended to planters. Attention is now being concentrated on botanical aspects. The following results were achieved in this scheme during the year.

A study on the progress of growth of cardamom panicles showed that :

(i) The rate of growth was comparatively fast in the Singampatti indigenous type, medium in the Singampatti creeping type and slow in the Ceylon type. The time taken by them to complete their growth

was between 9 to 11 months. There was no appreciable difference between the types in this respect. As a result of hybridization work started last year, it was found that cardamoms take 135 days to mature after fertilization.

During the year, 417 crosses were made among the Singampatti cardamoms and out of 702 seeds so far sown, 244 have germinated.

Hybridization between the various varieties and types was also started during the year and 190 crosses have been made so far.

(ii) In an experiment for determination of the length of mother rhizomes for vegetative propagation it was found that there was a definite advantage in using longer rhizomes.

(iii) To determine the best season for sowing nurseries, cardamom seeds were sown once a month in all months of the year. The germinations were poor in August and September while best germination was obtained in dry months from December to March. Control of thrips and scale is described in a later chapter. However, it was seen that while Gammexane reduced the thrips population by 57 per cent, the other insecticides did not do as well as Gammexane though they had some little effect as compared to untreated control.

It was seen that the dilute form of DDT 0.05 per cent was not very effective in controlling thrips. But DDT 0.25 per cent a more concentrated form, appeared to be as effective as nicotine sulphate and Gammexane in reducing the population of thrips. Final conclusions can be drawn only after continuing the trials for one more season. The experiment is in progress. Ammonium phosphate and superphosphate are effective in checking the spread of the clump rot disease and in stimulating quick revival of the affected plants.

Cloves (Travancore)

Some investigations on the insect pests of clove plants have been made during the year. As a result of the same, one species of insects, viz. Melanlonthidae (Cockchafer beetles) has been found as destructive to young clove plants though the damages caused on bigger plants are not so very apparent. The tender foliage and in some cases even the buds are eaten away by the insects and consequently the young plants die out in most cases. Some plants died out due to attack of collar rot and of insects combined with the severe drought which prevailed in the locality. Bordeaux mixture sprays and sulphur dusting were found effective against the diseases while Gammexane controlled the insects.

Turmeric (Orissa)

The following results were obtained in this scheme during the year :

1. *Betul* type was significantly superior in yield to all other types including the local *G. udayagiri* type.

2. Mother rhizomes used as seed material were superior to daughter rhizomes in respect of yields. This result was highly significant.
3. On the whole 6 in. $\times$ 6 in. spacing gave the highest yield.
4. There were no significant differences in yield between flat beds and ridges of different widths.
5. Turmeric in association with early paddy was a good combination.
6. Both in improved type of furnace of 1948-49 and in the modified local type of 1950-51 there was nearly 28.30 per cent economy of fuel. The modified type of furnace of 1950-51 is also superior to the improved type in the sense that iron drums were used in the improved types as containers thereby the cured turmeric after drying and polishing does not give finished products. It got blackened by the metallic drum by coming in contact with the metal. But in the modified local type earthen vessels were employed as containers and the final product does not give such dirty appearance.
7. The finished product obtained from turmeric cured in steam was superior in quality to that cured in cow-dung or with turmeric leaves. The scheme has been given an extension till 31 March, 1954.

Coriander (Madhya Bharat)

The wilt disease of coriander was studied to find out remedial measures. The information obtained so far may be summarised as follows :

1. First and second weeks of November offer the best sowing time for the coriander crop. During this period the germination percentage was fair and the wilting percentage low.
2. The fungus flourished more at 25°C. soil temperature, at which maximum wilting percentage was observed.
3. The experiment conducted to determine the temperature and moisture content of the soil in relation to the incidence of the wilt disease revealed that the soil temperature of 25°C. and 50 to 60 per cent moisture content of the soil were favourable for the development of the disease. The scheme has been given an extension for one year more (i.e. till 31 March, 1953).

Ginger (Madras)

The results of the Ginger Research Scheme did not show any definite correlation between the time of planting and yield, but it was seen that the moisture in the field at the time of planting appeared to have a very great influence on the growth and the yield of ginger. From the results it was apparent that with higher seed rates, higher yields were obtained. The crop was grown under the *pandal* and gave a significantly better yield than in the open. The crop grown under the tree gave a lower yield when compared to that in open. The yield was effected when the number of mulchings was reduced. Bordeaux mixture at 1 per cent was found to have a deleterious effect on the germination. No confirmatory evidence was given as to the effect of seed treatment along with fungicides from this trial in the first year.

Chillies (Madras)

The results of the chillies scheme showed that increased yields were obtained with close planting, even though it was intercultured only one way. This conclusion taken with the previous findings from the spacing experiments would seem to establish that two way interculture was superfluous. It was seen that there was a progressive increase in the incidence of thrips from November to December in all the variants and that large proportion of plants succumbed to the pest in December when planted late, viz. on 20 October and 4 November. The late planted crop was also poor in growth and this weak condition might have made it more vulnerable to thrip attack. The yields were progressively low. Among the pesticides P.520 was very conspicuous in its effect on foliage and renewed growth of the crop. This was reflected in a corresponding increase in ultimate yield. It would seem that BHC was more effective than DDT. Among the forms of BHC Gammexane P.520 was more spectacular than D.025. An extra yield of 603 lb. of ripe chillies was obtained with this insecticide. Allowing for the cost of the same and labour charges for application, there was still a profit of Rs. 90-13-6 per acre compared to the control.

Zira (Rajasthan)

The scheme for investigation on *zira* disease has started only recently.

Pepper (Madras)

The scheme was temporarily in operation at Taliparamba. The following important results have been recorded.

1. Layerings gave much better success than propagation through cuttings. The usual planting time for pepper was June to August and layering in this period gave the highest percentage of success. When cuttings were made they had to be planted as quickly as possible. It was also

seen that unless layerings or planting of cuttings was done during the rainy season results would be poor.

2. There seemed to be a positive correlation between the leaf size and fruit size.
3. It was clear that one of the most important factors affecting productivity in a pepper variety was the percentage of flowers on a spike which set into fruit. A general examination of productivity based on fruit setting of all varieties growing at this station showed that the varieties having predominantly bisexual flowers on their spikes were the most productive. Those having predominantly female flowers are found to be definitely less productive.
4. Intense shade tended to produce more female flowers than bisexual flowers. Consequently the amount of pollen available would have been very limited and the poor setting of berries could be attributed to this. It was observed that the production of spikes was also very sparse under thick shade.

Cash Crops (Spices) Enquiry Committee

The attention of the Indian Council of Agricultural Research has been drawn to the inadequate attention paid to the various aspects concerning the production and marketing of some important dollar-earning crops like pepper, cardamom, cashewnut, ginger, lemon grass, etc. and the need for taking concerted measures. A sub-committee of the I.C.A.R. has accordingly been set up to examine the whole question and in particular to consider whether centralised direction in the field of production and marketing was necessary and if so in what form. It was expected that the committee would finish its work by December 1952.

MEDICINAL PLANTS

Medicinal Plants Scheme (West Bengal and Madras). The object of this co-ordinated scheme was to find out the climatic and other requirements under which selected medicinal plants (which have a demand both at home and abroad) would develop optimum alkaloid content. The scheme was in operation at two centres. (West Bengal—Darjeeling, and Madras—Coimbatore and Nilgiris).

A new scheme for the cultivation of medicinal plants especially artemisia (for extraction of santonin) and ephedra (for extraction of ephedrine) has been sanctioned from 1-4-52 under the Forest Research Institute, Dehra Dun. The work would be carried out at Chakrata in Uttar Pradesh.

HORTICULTURE

Mango

At the Fruit Research Station at Saharanpur, U.P. 80 commercial varieties of mango have been collected and grouped under the

following four heads with a view to selecting better varieties on the basis of vigour and fruiting capacity.

1. Early ripening
2. Mid ripening
3. Late ripening
4. Polyembryonic

At the Fruit Research Station, Kodur, in Madras, one tree of *Chota Jehangir* gave a record yield of 1269 lb. of fruit. The year's choicest mangoes for quality that fruited are *Phirangiludwa*, *Alampur*, *Baneshan*, *Himayuddin*, *Shendria*, *Jehangir*, *Mulgoa* and *Chinnarasan*.

At Lucknow University in Uttar Pradesh experiments were continued to find out the cause of black tip disease of mango and its control. It has been confirmed that the incidence of the necrosis is correlated to the presence of the brick kiln.

Studies on the gall makers of mango leaves and shoots were continued in the plains of Uttar Pradesh. In addition to the previous year's collection of 12 galls, 10 on the leaves, one on the stem and one on the inflorescence, two more galls have been identified during this year, one on the mango leaves and the other on the mango stem.

Life and season histories of the following pests were studied in detail.

1. *Procontarinia matteiana*.
2. *Amraemyiaamraemya* Rao, *A. viridigallicola* Rao and *A. brunnei*.
3. Cecid flies causing pit and cone galls.
4. *Amradiplosis echinogalliperda* Mani causing echinate galls.
5. Cecid flies causing discoiled and domelike galls.

Citrus

In Madhya Pradesh, Madras, Assam, Orissa and Coorg various research schemes are in progress with a view to finding out the best varieties, suitable scionic combinations and quick and easy methods of propagations. The following results have been achieved so far.

In Madhya Pradesh the girth measurements of trees were taken on stock and scion parts. In all the cases girths of stocks exceeded the girths of the scions. The magnitude of difference between the stock and scion girths of each scionic combination tended to widen even more than that of last year. The minimum difference was observed in the case of *santra* (sour orange) and *santra* (Guinea lemon). The scion girths on all the stocks except *Jullunduri Khatti* were significantly higher than that of the sour orange. The stock girths of the four stocks, viz. *Jamberi*, sweet-lemon, *Jatti Khatti* and sweet-lime showed significant difference over *Jullunduri Khatti* and sour orange but the differences among them were not significant.

The varieties of citrus which were planted in 1948 and flowered and set fruit during this year are lemon, grapefruit and Malta. The crop was light and whatever fruit was set dropped down later on account of soil moisture.

As a result of the intensive work carried out in Assam for the last 12 years on the economic characters of citrus species both wild and cultivated found there, a large number of species and varieties have been described in a monograph which is under publication.

In order to find out the factors leading to the decline of orange trees in Wyanad, survey of orchards was continued and an area of 639 acres was surveyed during this year. It was observed that the deterioration was more in bearing orchards and was mainly due to neglect and lack of manuring. The decline was negligible in small orchards which were properly manured. It was also noticed that manuring improved the condition of the trees. Addition of lime to the soil at the rate of 20 lb. per tree led to the improvement of tree health.

Another survey of orchards comprising 2000 acres was conducted at Wyanad to find out the nature and extent of damage caused by the cerambycid borer during this year which revealed that about half of this area carried infection ranging from 50 to 100 per cent while in the remaining half the infection varied from 0 to 50 per cent. The pest species have been identified as *Chelidonium cinctum* Guer which were found to be of uniform metallic bluish green colour without yellow bands.

The citrus rootstock trials at the Fruit Research Station, Kodur, in Madras, revealed that *Sathgudi* trees on acid lime rootstock yielded more fruits, average per tree being 290 fruits as compared to 80 fruits per tree on *Kichili* rootstock in the previous year.

Banana

In order to effect improvement of banana by introducing better suited varieties and evolving better cultural practices a Central Banana Research Station was established at Aduthurai in Madras with two sub-stations one in Bombay and the other in West Bengal. At the Banana Research Station, Aduthurai, 136 varieties have been collected from different parts of the Union for study. Similarly a collection of 86 varieties was also made at the two sub-stations.

Apples

The following 14 varieties of apple were identified in Kashmir, out of which five are indigenous and the rest nine are exotic.

Early summer

1. *Ramchoo* (Indigenous)

Mid-summer

2. *Pindhwal* (Indigenous)
3. *Gilgati No. 1* (Indigenous)
4. *Bombay Trel* synonymn Para diet
5. *Kagzi Kharoo No. 1* Synonymn Pine-apple Russet (Dessert).
6. *Safer Kand* synonymn Millers (Dessert)
7. *Balpuri Trel* synonymn early (Culinary and Dessert)
8. *Bomchunth Trel* synonymn Blurked Calville

Late season varieties

9. *Mach Ambri* (Indigenous)
10. *Kadur* (Indigenous)
11. *Bomburi Turush* synonymn Stones
12. *Pindh Chunth* synonymn Minkler (Dessert)
13. *Kudusari Turush* synonymn Pope's scarlet custard (Dessert)
14. *Hand Turush* synonymn Nancy Jacksen

Custard Apples

Red custard apples and the Mammoth are the two leading varieties in Hyderabad from amongst the seven varieties of custard apples collected and tried at the Fruit Research Station, Sangaveddy.

Grape Vines

Bokhri is the highest yielder and has proved to be a hardy commercial variety in Hyderabad. The *Anab Shahi* variety has also proved to be a good cropper as well as a good quality grape in the State.

FRUIT PRESERVATION

Schemes on the fruit and vegetable preservation are in progress in the States of Punjab, Bihar and Assam. The aim of these schemes is to provide short courses of training in fruit preservation for the benefit of ladies. In Assam three courses of different durations, viz. nine months and three months and 15 days were organised. Under this scheme 120 ladies received training in short courses of 15 days specially conducted for their benefit at different places throughout the State. Four students completed three months' course and two students completed the advance course of nine months satisfactorily.

The progress reports from the Punjab and Bihar are still awaited.

VEGETABLES

Two schemes are in progress in the States of U.P. and Bombay since 1 April, 1951, for the improvement of vegetables. The various aspects of study are improvement of varieties, breeding of new varieties, improvement in cultural methods manurial requirements and

control of pests and diseases. Their annual progress reports are awaited. During the year another scheme has been sanctioned in Orissa.

Seven research schemes on the tuber crops are in progress in the States of Punjab, Bombay, Bihar, Orissa, Travancore-Cochin, Madras and Mysore. The object of these schemes is to evolve better varieties of tubers grown in different States. In Punjab S 8 and S 9 selections of *Colocasia* out of 71 tried have proved promising and in sweet potato, V2 variety proved superior in yield amongst the 180 collections tried so far. In Orissa and Madras work has been started on sweet potato and tapioca; results are still awaited. In Bombay work has been undertaken on sweet potato, tapioca, *Colocasia* and *coorka*. B-219 and B-4004 are promising varieties of sweet potato. In Bihar and Travancore-Cochin different tuber crops are being collected for trials.

The Annual Progress Report of the Mysore scheme is awaited.

Description of Important Varieties of Fruits Grown in India

Mango. The morphological descriptions of 197 important varieties of mango cultivated in the Union have been studied and a monograph containing coloured sketches and useful observations on their relative resistance to diseases and pests has been prepared for publication. Thirty-one minor varieties of mangoes have also been studied during the year.

Citrus. About 500 abstracts on systematic work on citrus have been prepared as preliminary to the compilation of a comprehensive bibliography.

Systematic tours in connection with the study of citrus varieties were made in Uttar Pradesh, PEPSU and Punjab in the months of March and April, 1951, to record morphological descriptions of trees, leaves and flowers. Complete morphological characters of trees leaves and flowers of 40 citrus varieties have been recorded so far.

Abstraction of Horticultural Literature

About 650 abstracts, summaries and extracts taken from about 250 journals, bulletins, leaflets, circulars and books published in India and foreign countries were taken. The abstracts were taken mostly from literature published in India and in foreign countries which are akin to Indian conditions. Out of these, about 150 abstracts were published in the *Indian Journal of Horticulture* and 350 in monthly leaflets. About 150 abstracts on fruit preservation were published, in *Indian Food Packer*. These abstracts are being circulated to about 400 horticultural research workers, research stations, colleges and libraries in the country.

VILLAGE REHABILITATION SCHEME—BARODA

This scheme was launched in 1946 with a view to studying the economic results accruing from different forms and land tenure and farming systems like leased tenancy, propriety collective and co-operative farming. The propriety system proved to be the best giving an average profit of Rs. 61-2-6 per acre, followed by leased tenancy which yielded a profit of Rs. 35-12-0 per acre. Next to it came the collective system with a profit of Rs. 29-8-0 per acre and the least remunerative was the co-operative system which gave a profit of only Rs. 15-12-0 per acre. As a rehabilitation scheme, it proved to be very successful. All improved agricultural practices were introduced and adopted by the farmers. These included improved seeds, manures and improved methods of cultivation. As a result high yields were obtained.

The scheme has been extended for another two years with effect from the 1 July, 1951, during which period the *tenancy in perpetuo* and the collective farming methods will be tried further.

SOIL SCIENCE

Minor and Trace Elements Research (I.A.R.I.)

The scheme has yielded further useful results. Eight samples of soils from healthy and diseased areas of Nopoklu (Coorg), ten samples from Jamalpur fruit gardens in the Punjab and four samples from citrus orchards at Nagpur were analysed for the mechanical composition and pH. It was observed in Jamalpur (Punjab) gardens that the surface one foot of the healthy area contained comparatively much less clay than that in the corresponding diseased area of the same garden. The pH of the healthy soils was slightly alkaline while those of the diseased ones were slightly acidic. In Nagpur soils the clay content increased with depth. The pH of all these soils were on the alkaline side and they contained CaCO_3 .

Total nitrogen in both healthy and diseased areas of Jullundur and Atari (Punjab) was higher in the top layers which gradually decreased with the depth. While the C/N ratio was found to be low, P_2O_5 and K_2O was fairly supplied in the upper layers. In Nopoklu (Coorg) soil C/N ratio was highest in the surface samples, which must be due to the use of some organic fertilisers low in nitrogen content.

The soil profile from Horadur (Coorg) was found to be quite rich in total Mn content, the available portion of it was, however, poor in this respect. With the dressing of NPK in organics and artificials it was found that trees got their major elements and also met their micronutrient deficiencies.

Several orchards in Nagpur were examined for deficiency diseases and every one of them was found to be more or less diseased. Two types of diseased systems were found in the orchards near Nagpur.

(i) Intervenal chlorosis with veins standing out green. Leaves were smaller in size than the normal ones.

(ii) A network of green veins in a lighter background. Leaves were normal in size. The former symptom was more prominent. The orchards in Coorg also showed the same symptoms of deficiency. The scheme has still to run for a year to reach final results.

Scheme for Nitrogen Fixation (I.A.R.I.)

The previous observations that *rahar* (*Cajanus cajan*) bore nodules only upto 8—12 weeks of its growth was confirmed. As regards yield of *rahar*, manuring with N alone was found to give best results followed by N. P. and P. Potassium had a depressing effect. Further experiments have revealed that the crop is endowed with the power of fixing nitrogen in addition to the amount fixed through nodulation.

Under the studies with gram-inoculation the results mentioned in the last year's report were confirmed. It was further observed that direct inoculation with soil should be preferred as that would be cheap and simple. But in a new locality where this is not possible pure culture should be recommended.

The yield of grain and tops of *rahar* and gram consistently increased with higher doses of molybdenum upto 5 ppm. in the case of *rahar* and upto 2 ppm. in the case of gram.

Further observations revealed that locality and variety both had their influence on nodulation and percentage of nitrogen. Delhi and Kanpur proved more effective than Punjab.

Soil Conservation Scheme (Himachal Pradesh)

This scheme could not be taken up by the State Government during the year under report due to certain administrative difficulties. This will now be taken up during 1952-53.

Scheme on Soil Erosion (Vishwabharati)

The scheme terminated on 31 March, 1952. The data so far collected is under statistical analysis, and the outstanding useful results obtained under the scheme will be included in the next year's annual report. In the meantime, the State Government has been asked to adopt the useful results in cultivator's fields over a compact area.

Manurial Experiments Scheme based on the Lines of Dr Stewart's Recommendations

The comprehensive Manurial Experiments Scheme on cultivator's fields sanctioned in the States of Madras, West Bengal, Bihar and Orissa and Bombay has started functioning in the first three States. It will be taken up by the other two States next year. Subject to the availability of funds, it is proposed to extend the work to the remaining four part 'A' States also from the next year.

Rapid Methods of Soil Test for Soil Survey Work

This scheme has been sanctioned at the I.A.R.I. The object of the scheme is to examine the rapid tests for soil and irrigation water which have been published and followed in other countries, investigate how far the results of such analyses could be correlated with actual crop responses in this country and so to select suitable methods which would be applicable under Indian conditions. In some cases modifications of the existing methods may be necessary.

Coordinated Scheme of the Study of Nitrogen Fixation Importance of some Leguminous Crops

The scheme has been sanctioned during the year in Punjab and Bombay. The object of the scheme is to investigate the comparative nitrogen fixing power (per unit of plant and per unit of area) of the important leguminous crops, to determine optimum conditions for nitrogen fixation, the influence of soil and climate, the effect of addition of phosphate and other fertilizers and finally to study the economics of these processes.

Standardisation Methods of Soil Analysis

The Soil Science Committee at its meeting held in October 1950, appointed a sub-committee to report on the methods of soil analysis in use in India and suggest necessary steps for co-ordinating these methods and to evolve standard and uniform methods so that the data obtained by one worker could be applied in the interpretation of results in other places all over India. Accordingly the sub-committee submitted a report in this connection which was considered and approved by the Soil Science Committee at its subsequent meeting held in 1951. The report was circulated to all the State Governments for their information and necessary action.

The Government of Madhya Pradesh approached the Council to get the research work of their Agriculture Chemistry and Botany Sections examined. Accordingly two expert Committees were constituted for the purpose. They have since visited the State and have submitted their report to the Government through the Council.

BOTANY AND PLANT PHYSIOLOGY

The following results have been recorded during the year 1951.

Variation of permeability, if any, in the cells of control, desiccated and vernalised embryos, to be observed by the electric method

Work on this item has been completed. Observations taken confirm the earlier conclusion that the electric conductivity of the vernalised embryo of mustard T-102 is greater than that of the control embryo at the same stage of germination.

Effect of chilling and dessiccation on isolated embryos in different cultural media

Three sets of experiments were undertaken for chilling embryos of mustard T-102 in different media, and the life cycles of plants from chilled embryos were compared with those of plants from control embryos. Thirteen different media were used for chilling the embryos of mustard T-102. No increase in earliness of flowering in plants from embryos chilled in different media so far tried could be observed. In the case of embryos chilled in media containing 2, 4-D and colchicine, the vegetative phase of the plants was prolonged considerably.

Metabolic changes in the embryos during the process of chilling

From the analysis of growing embryos isolated from control and vernalised seeds, it was found that catalase and diastase contents of vernalised embryos were higher, as also the carotene content.

Vernalisation response of the remaining available and new strains of Indian wheats

Experiments were undertaken to find out whether by the use of plant hormones and colchicine, earliness in ear emergence could be obtained. Late sowing was undertaken on December 11-12, 1950 and the seeds soaked in different concentrations of 2, 4-D, tibia and colchicine. No significant difference, however, could be observed.

Variation in the chemical composition of seeds from vernalised and control plants

The analyses of protein contents of seeds from control and vernalised plants of two strains of wheat SN 12 and SN 142, which gave earliness of 13.74 and 10.1 days respectively, were undertaken. It was found that, on dry basis, the protein content of seeds from control plants in the case of SN 12 was 13 per cent and in the case of vernalised plants 14.45 per cent. In the case of SN 142 the protein content from control was 11.06 per cent and from vernalised 14.08 per cent on dry basis, showing that factors, other than earliness in ear emergence are also responsible for higher protein content.

Presowing hardening treatment of crop seeds—(Delhi University)

The scheme terminated in March 1952 and the final results will be available shortly.

Wheat physiology—(Delhi University)

A new scheme for studies on the physiology of the wheat plant has been sanctioned in the Delhi University for a period of three years from 1 April, 1952. The studies will be confined to investigations on the chemicals basis of earliness and lateness and the correlations of specific characters in the crop which are easy to determine.

Presoaking seeds in nutrient salts (Madras)

A new scheme on the subject has been sanctioned in Madras for three years from 1 April, 1952. The object of the scheme is to find out if and how far, pre-soaking of seeds in suitable nutrient solutions can improve the yields of some of our important crops, and to see whether this method could be utilised to prevent nutrient deficiencies when crops are grown on soils deficient in major or minor elements.

INSECT PESTS AND PLANT DISEASES

Insect Pests

Tests with DDT and other allied insecticides were continued at the I.A.R.I., U.P. and Bombay.

Experiments at the I.A.R.I. revealed that although both DDT and Benzene hexachloride were effective for the control of termites, DDT between them was better.

Kharif grasshoppers, *Hieroglyphus banian Fabr.* and *nigrorepletus Bol.* In a field trial in U.P. against the nymphs and adults of the *kharif* grasshoppers on paddy crop during August, the percentage reduction in the population of the pest three days after the application of the treatments consisting of 5 per cent BHC dust at 20 and 10 lb. per acre, Toxaphene 20 per cent dust at 20 lb. per acre, sodium fluosilicate-bran-molasses-water bait (1 : 15 : 2 : 6½) at 40 lb. per acre and no treatment (control) was 85.0, 42.8, 74.0, 18.8, and 12.9 per cent respectively. Amongst these, five per cent BHC dust (Hexyclan 5 per cent dust) at 20 lb. per acre proved to be the most economical and significantly more effective than any other insecticide except 20 per cent Toxaphene which, however, was slightly less effective than the BHC dust.

Application of dust formulation of BHC 10 per cent and Chlordane 5 per cent in equal proportion gave 88.3 per cent kill of Deccan wingless grasshopper (*Colemania* sp. at Bombay (Ranemennur-Dharwar).

Singhara beetle, *Galerucella birmanica Jac.* Trial conducted against all the stages of the pest on *singhara* vines (*Trapa bispinosa*) in U.P. (at Uttripura—Kanpur) during October with 5 per cent dusts of BHC and DDT, tobacco dust and Pyrodust 4000 each at 30 lb. per acre, the reduction in the population of the adults, four days after the treatment, was 85, 72, 78 and 40 per cent respectively, as against an increase of 7 per cent in the control. Mortality of the grubs was practically complete under all the treatments except under control where there was an increase of 10 per cent in the population of the grubs. Tobacco dust appeared to act more slowly than BHC dust. No injury to the foliage was noticed in any of the treatments.

Mustard aphids, *Siphocoryne indobrassicae* Das. Spraying of rye crop (*Brassica juncea*) in U.P. which was heavily infested with the nymphs and adults of the mustard aphids, with Pyrocolloid (1:600), tobacco decoction (tobacco, soap and water, 1:1:150), 0.10 per cent DDT suspension and 0.1 per cent BHC suspension, each at 50 gallons per acre, caused a reduction in the population of the pest by 75, 51, 53 and 54 per cent respectively, as against a mortality of 28 per cent in the control four days after the treatment. None of the insecticides, however, caused substantial reduction in the population of the pest to achieve practical control. This indicated the necessity of increasing the dosage of spray liquid to about 75 or 100 gallons per acre to drench the crop completely as the same strengths of the insecticides used had given much higher mortalities of the aphid under laboratory conditions.

Potato Epilachna beetle, *Epilachna vigintioctopunctata* Fabr. Trial on potato crop in U.P. infested with all stages of the pest using 0.25 per cent emulsion and suspension of DDT, 5 per cent DDT dust, Product G 205 P (containing 5 per cent DDT and pyrethrin), Pyrocolloid (1 : 500) and Pyrodust 4000 indicated promising results.

Mango hopper control. 5 per cent DDT sulphur 1:1 was quite effective against this pest. Sulphur was an essential ingredient for controlling the mildew and DDT for controlling the hoppers. Experiments conducted this year in Bombay at Dharwar show that 1 : 1, 1 : 2 dilutions of 5 per cent DDT sulphur gave nearly equal control. The mortality obtained by these was of the order 97 per cent, 95 per cent respectively. These were therefore equally toxic, but it was thought that the frequency of dusting would be more in the lower dilution of 1:2 because of decreased residual effect.

The laboratory tests were carried out at Kanpur in petri dishes during February-March with first, second and third instar nymphs which were kept in contact with 10 per cent DDT and 50 per cent BHC dusts for 30, 90 and 120 minutes respectively. DDT appeared to be slightly more effective than BHC and the previous finding that none of them could cause a substantial reduction in the population of the pest in the field was confirmed. A preliminary test with 0.1 per cent Parathion against the second instar nymphs allowing them contact for 15 and 30 minutes gave encouraging results, since in both the cases all the test insects were either dead or moribund 48 hours after the treatment.

Common house fly. In U.P. a preliminary test against the house flies emerging from cattle-dung manure heaps with 5 per cent BHC and DDT dusts each at 50 and 100 lb. per acre, killed 53.3, 9.3, 70.0 and 21.3 per cent of the freshly emerged flies within six days of the treatment. BHC proved more effective than DDT.

Experiments conducted in the Entomological Laboratory, Poona for the control of fly breeding in the compost and farmyard manure indicated that water suspension BHC 0.8 per cent and DDT 0.8 per cent emulsion were equally toxic and gave more than 90 per cent mortality. DDT 0.8 per cent water suspension was, however, less toxic.

Termite research. Three schemes of termite research have been sanctioned. Two of these were Termite Research, F.R.I. and Termite Research, Indian Agricultural Research Institute. The object of these schemes is to study the biology, morphology, distribution and systematics of the Indian termites in order to devise suitable measures for their control. The former is concerned mainly with systematic work and the latter with the biology and control of termites affecting agricultural crops. The third, Termite Research Institute, Anand, Bombay State, was intended to devise control methods of termite infestation on timber and on stems of fruit trees, to check damage by this pest to crops like sugarcane, groundnut, cotton, wheat, etc. and to find out the relation of the amount of organic matter in the soil and prevention of termite.

Phytotoxicity trials. Five per cent dusts of DDT and BHC at 50 lb. per acre were applied twice or thrice, at weekly intervals on young plants of lady's finger; *kakri* (*Cocumis utilissimus*), *torai* (*Luffa* sp.), *kaddu* (*Cucurbita moschata*), bitter gourd, *tinda* (*Citrullus vulgaris* var. *fistulosus*), and bottle gourd, at Kanpur during April-May. No symptoms of injury to leaves or stunted growth were noticed on the plants of lady's finger, *torai*, bitter gourd and *kaddu*. *Kakri* plants suffered adversely both with BHC and DDT. Bottle gourd was badly affected by the use of BHC but very slightly by DDT.

Synthetic insecticides (Punjab). The object of the scheme was to study the insecticidal value of the indigenous plant resources with a view to replacing, if possible, the imported synthetic products as well as to achieve self-sufficiency. The trials carried out under the scheme in Punjab have given some promising results which lead to the following tentative conclusions.

(i) Water extracts of *dharek*, *dhatura* (*Datura alba*) and *ak* (*Calatropis procera*) leaves in 50 per cent strength, and of *ak* and *kaner* (*Nirum odorum*) flowers in 100 per cent strength, gave medium mortality in case of the adults of painted bug and fourth instar larvae of cabbage butter-fly.

(ii) Water extracts of *dharek* berries (*Melia ozadirachta*) and *dhatura* fruits in 50 per cent concentrations proved slightly toxic on the insects stated above.

(iii) Water solution of the latex of *danda thohar* (*Euphorbia royleana*) and water suspension of latex of *ak* in 10 per cent strength yield medium mortality in painted bugs.

(iv) Similarly, 40 per cent emulsion of the oil of *satyanasi* seed resulted in medium mortality in the adults of red pumpkin beetle.

(v) Dust prepared from the leaves of *dharek*, *dhatura*, *ak* and *kaner* (in pure form), proved ineffective against painted bugs.

Insect pests of stored cereal grains (Punjab)

Relative efficacy of hessian bags, *theka* (a receptacle made of thick cotton cloth) *perhu* (receptacle made from bamboo sticks) *bukhari*, *chatai*, *kothi* (box-like mud-bin) and *bharola* (cylindrical mud-bin receptacle, date-palm leaves encircling bamboo) was studied by liberating 50 grubs of *Trogoderma granarium* Everts. and 12 laboratory bred adults of *Sitophilus oryza* L. in each receptacle containing 2½ maunds of healthy wheat. The highest damage of 213 per cent was recorded under *chatai* and the lowest 3.6 per cent under *theka* in a single storing season. Various chemical dusts, namely, Neohexapure (0.75 gamma isomer), hexidole 805 (5 per cent BHC), D.034 (4 per cent BHC), Geigy 33 (10 per cent DDT) and G 205 P (5 per cent DDT and stabilised pyrethrum), pyrodust 1500 and pyrodust 4,000, were tried in small kerosene oil tins against *Trogoderma granarium* Everts. and *Sitophilus oryza* L. at the rate of 2 oz. per cwt. of wheat. Pyrodusts 1,500 and 4,000 proved practically ineffective. Other dusts, however, proved fairly effective but none of them was able to check the multiplication completely because in spite of the treatments some insects survived and their number varied from 0.2 to 1.0 per container. Similar results were also obtained in earthen pots against *Trogoderma granarium* Everts., *Rhizopertha dominica* F. and *Tribolium castaneum* Hbst. This experiment has been repeated with slightly higher doses of each insecticide in order to get complete mortality if possible.

Fumigation with methyl bromide under waxy tarpaulin was tried during winter. A dose of one pound per thousand cubic foot and 12 hours exposure, prove quite ineffective during December 1950 when the temperature varied from 53°F to 67°F. An increased exposure of 36 hours also did not give cent per cent kill. When the dose was increased to 1.5 lb. per thousand cubic foot and the exposure increased to 24 hours, 100 per cent adults of *Rhizopertha dominica* F. and *Tribolium castaneum* Hbst. were killed but it had no adverse effect on grubs or *Trogoderma granarium* Everts. at temperature varying from 53°F to 77°F.

Methyl bromide. Wheat stored in gunny bags or in bulk in *pucca* godowns was treated with methyl bromide at the rate of one pound per thousand cubic feet and exposures of 10 hours, 12 hours, 16 hours and 24 hours during July to September when the temperature varied from 84°F to 101.2°F. The mortality was cent per cent in the adults of *Sitophilus oryza* L., *Rhizoperthan dominica* F., *Tribolium castaneum* Hbst. and grubs of *Trogoderma granarium*

Everts. Exposures above 12 hours, however, affected the germination of wheat adversely to the extent of 6-13 per cent. The cost of fumigation at this dose was worked out at one pie per maund of wheat.

Ethylene dichloride and carbon tetrachloride mixture. Efficacy of a reduced dose with increased exposures was under trial. To start with the dose of 101 lb. per 1,000 cubic feet (half the recommended dose) was tried with an exposure of 168 hours in order to get the maximum mortality. Having observed cent per cent results, the exposure was reduced to 80 hours to determine the lower limit because it was presumed that with the exposure of about 48 hours the insects will not be killed with the reduced dose. Even at 80 hours exposure the mortality with this reduced dose in case of *Trogoderma granarium* Everts., *Sitophilus oryza* L., *Rhizopertha dominica* F. and *Tribolium castaneum* Hbst. was cent per cent. Relative toxicity of dry films of DDT and BHC against *Rhizopertha dominica* F., *Sitophilus oryza* L., *Tribolium castaneum* Hbst. and *Trogoderma granarium* was studied on different surfaces such as pucca bricks, pucca bricks white washed, cement plaster, hessian cloth, coarse khadar cloth (*theka*) and *koth*. The formulations were used in the concentrations of 0.1 per cent, 0.5 per cent, 1.0 per cent, 2.5 per cent, 3 per cent and 5 per cent. The important conclusions are,

(i) BHC formulations were more quick acting than DDT formulations.

(ii) Of all the formulations of both DDT and BHC suspension ranked first, emulsions second and the solutions third in their toxicity.

(iii) The toxic effects of DDT and BHC were more pronounced on coarse khadar cloth and hessian cloth than on other surfaces.

(iv) Five per cent concentrations of BHC and DDT in different formulations gave 100 per cent mortality on all the surfaces.

(v) Adults of *Rhizopertha dominica* F., were most susceptible to all doses of DDT and BHC formulations. Their relative response to both was practically the same.

(vi) Adults of *Sitophilus oryza* L. were more susceptible to BHC than to DDT whereas those of *Tribolium castaneum* Hbst. behaved in the reverse order.

(vii) Grubs of *Trogoderma granarium* Everts. were resistant or immune to all the formulations of DDT and BHC used in various concentrations.

Since five per cent dry films of DDT and BHC proved effective against all insects on all surfaces and in all formulations these were given further trials in order to determine their persistent toxicity.

The results so far obtained indicate that,

(i) Surfaces treated with BHC formulations started deteriorating in their action earlier than those treated with DDT.

(ii) Surfaces treated with DDT solution proved lethal upto 40 days after which their toxicity declined in the case of *Tribolium castaneum* Hbst.

(iii) Surface treated with DDT suspensions and emulsions maintained their lethal effect even after 70 days.

(iv) Surfaces treated with suspensions, emulsions and solutions of BHC kept up their toxic effect upto 30 days after which they started losing their toxicity but relatively more in the case of *Tribolium castaneum* Hbst.

(v) Surfaces treated with 5 per cent and 10 per cent dusts of DDT and BHC became ineffective 20 days after their treatment.

PLANT VIRUS

Dolichos enation mosaic. Experiments in Bombay in crops protection in White Burley tobacco with *Dolichos enation mosaic* (DEM) virus and tobacco mosaic (TM) virus showed that protection to tobacco plants was not afforded by either of the two viruses against the second; except tobacco, plants inoculated with TM virus were inoculated on the same leaves after 4 and 6 days with DEM virus. This is believed to be due to the possibility that previously inoculated tobacco leaves probably did not remain suitable for reinoculation with the DEM virus. The host range of the virus was further extended, and symptoms on *Nicotiana tabacum*, Var. White Burley differs in detail from those produced in this host plant by the tobacco mosaic virus.

Datura mosaic virus. The effect of dilution on the infectivity of the purified virus protein was studied. It was found to be infective even at a dilution of 10^8 . Studies on the ultra-violet light absorption of the virus protein in a 0.015 per cent solution showed that the maximum absorption is in the range of 200-270 mμ. By the improved method of virus purification, about 2.2 gm. of the pure virus protein was obtained from a litre of sap. Aphid species even after sufficient fasting failed to acquire the virus from diseased *Datura innoxia*. On the other hand, *Myzus persicae* colonised on diseased *D. innoxia* Var. *fastuosa* readily transmitted the virus to *D. innoxia*.

Catjang mosaic. Six cowpea varieties were tested for resistance or tolerance to the virus by mechanical inoculation. The varieties Alacrowder, Early Sugar Crowder, Suwannee, and Taylor were considered to be resistant to the virus, and the variety early red as highly tolerant.

Mosaic of Cucurbita mosehata, mosaic disease of brinjal and 'little-leaf' of Vinca rosoa. The virus of the last was easily transmitted by bud or wedge grafts, but not by inoculation of expressed juice. It is, however, readily transmitted by the leaf hopper, *Eutettix phyciti* and is shown to be the same virus which cause 'little leaf' disease in brinjal.

Mosaic of Lagenaria. Transmission tests carried out with *Aphis malvae*, *Myzus persicae*, *Alapcophora abdominalis*, and an unidentified coccid gave negative results. The indication of the virus being transmitted by *Myzus persicae* after a short infection feeding period was obtained in one experiment.

Mosaic of Carica papaya. Inoculations made from naturally diseased *Lagenaria vulgaris* and *Cucurbita moschata* to *Carica papaya* failed to produce any disease in papaya, indicating that neither of the two viruses cause the mosaic disease in papaya, and that the papaya mosaic virus is distinct from both.

Kattee disease of cardamom. The work of eradication of the *Kattee* disease was extended to another 450 acres in North Kanara. Wherever the cultivators are co-operating in this scheme, the disease has been kept in check. The possibility of employing a systematic insecticide against the vector was investigated. Various species of aphids tested were found to pick up the virus from affected papaya plants in feeding periods of three minutes. The viruliferous aphids exhausted their virus content after feeding on the first papaya plant. The virus seems to have no significant latent period in the vector.

CHAPTER III.—ANIMAL HUSBANDRY RESEARCH

LIVESTOCK BREEDING

Cattle

Cattle breeding. At the Government Livestock Farm, Hissar, a Livestock Investigation Scheme has been in progress since 1943 with a view to evolving a dual-purpose animal out of the Haryana cattle by a process of careful breeding. The important economic characters in Haryana cattle, i.e. milk production and draught ability were intended to be suitably combined, so that the females evolved could yield an optimum quantity of milk, while the males would make efficient draught animals without undue strain or fatigue. The scheme started with a foundation stock of 150 heifers and 80 dairy cows of typical Haryana breed, selected from the Hissar herd without giving undue prominence to their milk qualities. These animals were divided into ten families, each headed by a Haryana bull. The usual records relating to breeding and production have been maintained. Statistical studies of the data collected is now proposed to be undertaken. Of the observations made during the year, items worthy of note were : the average reaction time taken by the bulls in the scheme was 21 minutes 35 seconds ; statistical analysis has revealed that on an average a farm-bred bull takes about 7 minutes 24 seconds more in serving a cow than a purchased one. Tests for detecting *brucellosis* infection were applied to the experimental herd and those found positive to the tests were segregated and, with other usual measures applied, the disease was kept under control.

This scheme has had many vicissitudes and the progress has not been as was expected at the commencement of the scheme. There were several changes in the officer-in-charge of the scheme. The area has been affected by famine for the past several years. Sufficient number of F_1 and F_2 progeny, both male and female, of the foundation stock are now available. The question of returning the foundation stock to the Hissar herd and of culling the male progeny is now under consideration. This is being done so as to allow the feeding of the progeny to be undertaken on an adequate and scientific basis and to prevent the reflection of famine conditions on these progeny. An *ad hoc* expert committee has been appointed to enquire into the working of the scheme. The Animal Geneticist has been appointed on a long-term basis.

A similar scheme was in progress in Madras State (Palayakottai) with the object of improving the milking qualities of the Kangavam breed, a recognised draught breed, without lowering its draught ability. This scheme has been in progress for nearly ten years. In the earlier stages promising results were indicated in the matter of milk yield of the foundation stock which were obtained from the private herd of Pattager

of Palayakottai. The area in which the scheme is in operation is subject to periodical famines and the inadequate feeding had considerably affected the results, particularly the milk yield of the animals. Adequate arrangements have now been made for the proper scientific feeding of the experimental animals so that the effects of famine conditions might not be allowed to vitiate the results.

The pre-handling of udders experiment in the heifers appears to have yielded very successful results. The data collected will be subjected to a statistical analysis in order to test the conclusions arrived at before recommending the practice for general adoption.

At the I.D.R.I., Bangalore, the scheme for using Sindhi milking cows for draught as well as milking and breeding purposes continued to function satisfactorily. The scheme which was sanctioned for a period of three years from 1 April, 1949, has been extended for another two years with a view to obtain conclusive results from data collected for four locations.

The scheme to study the influence of marketing and insurance on cattle improvement in villages in Patiala progressed satisfactorily. The scheme has completed three years. 4,916 maunds of milk were sold for Rs. 98,928 resulting in a profit of approximately Rs. 14,000. A sum of Rs. 9,365 has been collected in the insurance fund and a sum of Rs. 1,750 has been paid out of this fund for replacement of five buffaloes which had died. The cattle owners who have joined the scheme are showing keen interest in growing fodder crops and are bringing uncultivated area under cultivation.

The experience gained by the Council in working cattle improvement schemes and pilot key village schemes has culminated in the approval by the Planning Commission of a scheme styled 'Key Village Scheme' for the improvement of livestock in India. It has for its object the progressive improvement in the milking and working efficiency of the vast millions of India's cattle population. This is sought to be done by the establishment of a network of about 600 intensive cattle improvement areas, called 'Key Villages', throughout the country. These areas will be compact and will contain at least 500 cows and/or she buffaloes over three years of age. All aspects of cattle development, namely, breeding, feeding, disease control, management, and marketing will be attended to, and the areas will be developed eventually to work as though they were regular cattle-breeding farms. The owners in each key village will gradually be combined into a co-operative organisation to which the work will be handed over as and when it is found that they could carry on the work independently.

Only high-class pedigree bulls will be maintained in these villages and their breeding will be strictly controlled with the object of knowing which bull served which cow and when, so that the key villages may ultimately produce bulls of known parentage and productive value. In order to accelerate progress full use will be made of the modern technique

of artificial insemination for which a total of 150 artificial insemination centres has been sanctioned, at the rate of one centre per four key villages. The bulls produced from these villages will be distributed in the surrounding areas, in accordance with a carefully prepared plan, in an ever widening circle which will eventually cover the whole country.

From the third year of the scheme it is contemplated that selected bull calves produced in key villages should be reared upto maturity in Government sponsored farms called Bull Rearing Farms. These farms will serve as the nursery for the supply of bulls to key villages as well as to other areas to which the benefit of cattle improvement will be extended. The necessity for these farms is that cattle owners are not very enthusiastic to maintain more cattle than they require. These farms will preserve animals of known pedigree which may otherwise be lost as breeding bulls. It is proposed to set up about 225 farms during the first phase of the plan and the remaining in subsequent years.

In 1951-52 the Government of India sanctioned 92 Key Farm Centres in Government as well as private institutions at a total cost of Rs. 7.46 lakhs out of the 'Grow More Food' funds. About 50 of these centres started functioning and others will commence work soon.

Key villages and artificial insemination centre at Bawana (Delhi). Under this Pilot Key Village Scheme useful work was done in the 10 villages under the intensive Rural Development Scheme. After a preliminary house to house survey of the cattle breeding position, all the stray bulls in the area were removed and breeding control introduced. During the year 237 animals were artificially inseminated. The percentage of successful impregnation is 73 to 75 which considering the working conditions is quite high compared to that in other countries. All aspects of cattle life in the villages were attended to.

The Pilot Key Village Centre (U.P.) This centre which has been working at village Chatta in Mathura has been remodelled on the lines of the All India Scheme of Key Village and Artificial Insemination.

The pilot scheme in Travancore-Cochin commenced working during the year.

Selective breeding and grading of indigenous cattle. A scheme rather original in its nature, has been sanctioned for trial in Orissa. So far no experiments have been carried out for investigating grading-up with well-defined breeds. Selective breeding of distinct indigenous types is an important problem in the backward areas of India. The Orissa scheme has this object in view and is expected to be followed by similar work elsewhere.

Various attempts were made in the past to evolve a measure of draught ability of cattle. These were in terms of the maximum pull or body measurement or respiration rate. None of these was, however, found satisfactory. A special committee was set up which recommended a plan of work to be taken up at two centres. Accordingly one project has been sanctioned for trial at the I.V.R.I. It is expected to take

up the work at Hissar also if the *ad hoc* committee recommends its being taken up as a part of the Livestock Investigation Scheme. A dynamometer to be used in the experiments is under construction at the Agricultural Research Institute, Allahabad.

Definition of breed characteristics of the Amritmahal and Hallikar breeds of Mysore. A scheme has been sanctioned for determining whether the Amritmahal and Hallikar cattle of Mysore belong to two different and distinct breeds or are strains of the same breed. The characteristics of the breed or breeds will also be defined so that 'Herd books' can be initiated and the development of the breeds taken up on scientific lines.

Definition of grey breeds. The study of the eight grey breeds of India was not making headway. An officer on special duty had to be appointed to undertake the study. The object of the study was to enumerate the points of similarity or otherwise in the different types of grey cattle in Central India so that the breeds to which they belong might be determined and the efforts at cattle improvement concentrated on those breeds. The study was in progress at the end of the year.

Central herd books section. The section continued to register new animals in 'herd books' and to register births, deaths and transfers of cattle. Detailed studies of the records of performance could not be undertaken for want of staff.

Sheep

Improvement of sheep and wool on regional basis

The scheme for improvement of sheep and wool on regional basis, comprising of three regions, viz. the temperate (Himalayan), the dry (Northern) and the southern (Deccan plateau) regions, was put in operation in Bombay, U.P. and Kashmir. As a necessary prelude the old sheep breeding schemes in Bombay and Kashmir were merged in the new centres and those in Madras and Punjab were terminated.

(i) *Temperate Himalayan region.* It is proposed to carry out cross-breeding local ewes with Rambouillet rams imported from the U.S.A. and also to carry out selective breeding of indigenous sheep. The regional station is located at Pipalkoti in U.P. hills with a fleece-testing laboratory at Kalsi in Dehra Dun district. A sub-station will be established in Himachal Pradesh during the next year.

(ii) *Dry northern region.* In this region experiments on selective breeding of indigenous sheep (e.g. Bikaneri, Jorisa, etc. types) will be carried out. Arrangements are being finalised for establishing a main station in Rajasthan, with a sub-centre in Joria (Bombay State).

(iii) *Southern region.* Experiments on both selective breeding of indigenous sheep and cross-breeding with Rambouillet rams imported from the U.S.A. will be carried out in this region. The main station with a wool research laboratory has been established in Poona and arrangements to establish two sub-centres, one in Mysore and the other in Nilgiris (Madras) are being finalised.

Sheep Breeding Scheme, Hosur (Madras). Its object was to evolve a white woolly sheep by grading Bellary ewes with Bikaneri rams, better in quality and quantity of fleece yield as well as in the weight of the carcass than the local sheep. The work of grading up has registered a definite improvement in regard to weights and quality of wool in graded stock. After running for nearly 14 years the scheme has been terminated as the objectives had been realised and enough data was available for the State to plan future work. A final and fully informative report is under preparation.

Sheep Breeding Research and Wool Analysis Laboratory, Poona (Bombay). The main object of the scheme is to improve the wool carrying capacity of the Deccani sheep by selective breeding and by cross-breeding with the Merino (or Rambouillets). A fifth generation of selective breeding has resulted in building a flock of all-wool sheep. The rams from this flock are appreciated by the shepherds because grading up their flock with these improved wool quality of their sheep. While the average Deccani white wool is of coarse carpetwool quality, the stock at the farm have given wools of tweeds and blanket quality. By cross-breeding and back-crossing, two different categories of fine wool type sheep have been developed, the first one with quality range of 50-60's, and with a staple length of $3\frac{1}{2}$ in. and the second category comprising four different strains with different quality counts. For the selection of sheep, the fleece density is considered to be the criterion for dam-daughter comparison and it has been found that the earliest age at which this character could be studied in lambs was two months. An interesting study has been taken up to collect data regarding meat production and economics of sheep rearing.

Sheep Breeding Scheme, Banihal (Kashmir). The aim of the scheme is to evolve a Kashmir Merino by cross breeding. The scheme suffered severe set-back due to most of the experimental flock being taken away by raiders. Some of these were recovered and the flock was strengthened by the addition of more ewes and by purchases of Rambouillets rams. The results achieved so far indicate that $3/4$ and $7/8$ bred sheep would be fairly suitable. The Council has suggested to the State that if possible some of these rams ($3/4$ and $7/8$ bred) might be put in the villages with a view to studying their adaptability under village condition.

The Indigenous Sheep Breeding and Wool Analysis Laboratory at Hissar (Punjab). The scheme was terminated on 31 March, 1952. Its object was the evolution of a fine-wool-type sheep from existing flock of indigenous Bikaneri sheep and to study the maintenance of flock on economical basis. There were scarcity conditions in the beginning of the year which were, however, tided over by good rains resulting in ample grazing. Percentages of conception in 'A' and 'B' type flock was 77.9 to 82.8 as compared to 63.6 and 62.8 of previous year. Observations so far made confirm that by improving wool there is decrease in the size and fertility and weaning weights of lambs, but there

is no effect on fleece-weight and mortality. It was, however, thought probable that size could be maintained through proper selection and a separate line of large-sized ewes and large-sized 'A' type rams has been set up. The question of testing of male lambs before they sire, was examined and a number of lambs from birth were adequately fed; and it was observed that they could sire when aged 6-6½ months. It is thus possible that their progeny can be tested before they are used as sires. A steady improvement was maintained in the selective breeding for wool and now the 'A' and 'B' type flocks predominated. The results of the work done during the first 10-year period of the scheme are being analysed and it is hoped that results will be made use of in the major wool producing areas of the country.

Wool Analysis Laboratory (Bombay University). The laboratory continued its valuable work of economic importance in assessing the potentialities of Indian sheep. Analysis of samples of regional wool from pure breeds of indigenous sheep were in progress. The hydrolysis products of wool and hair fibres were examined to study the difference which might exist in the two types of fibres as far as the amino acid contents were concerned. The hydrolysates were subjected to proper chromatographic analysis to identify the individual amino acids. The behaviour of the medullated and wool fibres towards acids, alkalies, salts and dyes were exhaustively studied. Among other problems tackled were the supercontraction studies and the change in the sulphur, nitrogen and moisture contents with the quality of wool. Some attempts were also made to use the variability of these properties for assessing the medullation. Since most of the work done elsewhere concerned all-wool fibres and medullation was a very distinctive characteristic of Indian wools, such a study was thought to be appropriate. An extension upto 31 March, 1933, has been sanctioned to complete chemical investigation to facilitate the systematic study of the wool fibres and fabrics with reference to (i) the spectroscopic determination of elements in wool and hair fibres and (ii) formation of polymers in wool and hair fibres.

Wool Analysis Laboratory at Gaya (Bihar). The work done has helped in selective breeding and up-grading of flocks in farms by recording the wool quality of individual sheep. The laboratory also records the individual performance of lambs produced by crossing the *desi* animals with Bikaneri rams. The period of the scheme has been extended until such time as a sheep and wool development scheme for the eastern region was approved.

Training Course in Sheep and Wool Production

The Animal Husbandry Wing (1949) considered the means of providing for the highest standards of veterinary education and training in India needed to meet the national requirements in research specialists, investigators, teachers, workers, etc. and recommended as one of the measures, the institution of a diploma course for training in sheep husbandry and wool technology of one year's duration at the Government

Livestock Farm, Hissar, to be offered as post-graduate training to graduates of agriculture and veterinary science in India. The I.C.A.R. has accordingly sanctioned a scheme for instituting a course of training in sheep husbandry and wool production as an experimental measure for one year. The course is intended to include a study in veterinary science in relation to sheep breeding, farm management and wool production. The course would also be available to workers in agriculture, animal husbandry and allied sciences to be deputed by various States and Central Government Departments and other recognised institutions. The course would start on 1 September, 1952.

Research in Developing Mutton Breeds of Sheep and Goats

Emphasis had so far been placed on the development of sheep for producing wool, Angora goat crosses for building up the mohair industry and goats for breeds of superior milk strain. The Council recently decided to turn its attention to the development of sheep and goats for mutton as well.

In the southern region sheep are maintained mostly for mutton and hence it was decided to improve the following breeds to begin with.

- (i) Nellore sheep in Madras State
- (ii) Mandya sheep in Mysore State
- (iii) Tonguri sheep in the Bombay Deccan

A scheme has been sanctioned by the Council for five years from 1 April, 1952. Its object is to study the potentialities of these breeds and to explore the possibilities of obtaining superior hybrids both by inter-breeding and out-breeding keeping in view the adaptability to local feeds. Rams from the hardiest type of fat-rumped sheep available in Somaliland and the fat-tailed Dumba breed will be used in cross-breeding. Research will be carried out in existing sheep breeding farms in the three States of Bombay, Madras and Mysore. A Meat Technologist will be appointed to develop this part of sheep industry on sound and economic lines.

This work will be followed up by research on mutton goats also for which a scheme on all-India basis is being drawn up.

Goat

Indigenous Goat Breeding Scheme (Punjab). This scheme was indicated in November, 1949, at the Government Livestock Farm, Hissar. The main objects of the scheme are to build up a flock of Beetal goats of superior milk strain by suitable breeding methods, to investigate factors of economic importance to goat breeding in general and to supply pedigree male goats to districts in the Punjab and other States. During recent years progress was considerably hampered owing to interruptions by disease. Attempts were, however, made to keep down mortality. An outbreak of encephalomyelitis in male kinds has been controlled by treatment with Vitamin B injections. Studies on the fixation of breeding seasons indicate that high kid mortality could be reduced if kids were allowed to drop in the period from July

to October. There was no appreciable progress in milk yield. The whole breeding plan has been overhauled and breeding on five families instead of 10 has been taken up recently. A sub-committee has been appointed to examine this scheme and to make suitable suggestions for improving its usefulness.

Goat Improvement Scheme (Travancore-Cochin). This scheme was sanctioned for five years with the object of selective breeding of Malabar goats, which are known to contain predominantly Surti blood, in order to develop the potentialities of the breed and for distribution of progeny-tested bucks from this scheme to the rural areas. Due to delay in procurement of stock the scheme has started only from 1 July, 1951 and is working according to approved programme.

Goat Breeding Scheme (Orissa). It was started with a view to improve goats in Orissa by grading up locals with Beetal goats and also by selective breeding in Beetals and Black Banjals. Although the first few years showed good promise, there were heavy casualties subsequently due to contagious pleuropneumonia and encephalomyelitis. As the line of experiment could not be maintained with the small number of animals and as Beetal failed to thrive under Orissa conditions, the scheme was terminated.

Breeding Angora goat crosses for mohair (U.P.). As a result of experiments carried out for a number of years at Hissar, Punjab, a type of Angora goat for mohair was evolved but successive decreases in size occurred in the graded progeny which were much smaller than pure hill or pure Angora. With a view to studying the part played by climatic factors and also to evolving a type suitable to the hilly regions the scheme was transferred to Pipalkoti in the U.P. hills in April 1950. So far preliminary trials only were carried out at the new site. Foundation stock was increased by addition of 102 Himalayan hilly goats and 13 Tibetan Pashmina goats. It appears that humid climate does not probably suit Angora and the shifting of the site to Kalsi where the atmosphere is dry, is under consideration. Fleece analysis showed a very fruitful development of Angora mohair in the domestic goats. The development of fibre quality showed a rapid change and by the third generation had reached the extra super kid quality or the best quality in American mohairs. Heavy mortality occurred due to an outbreak of goat pox for the control of which help was obtained from the I.V.R.I. It is expected that the animals would do better in subsequent years after being acclimatised to local condition.

Three of the four Angora bucks imported from the U.S.A. died due to disease and arrangements are being made to replace these by new stock before the next mating season.

Poultry

Poultry Developmental Research Scheme (Madhya Pradesh). The scene of experiments was shifted from Sonaghati Farm, Betul, to Poultry Research Station, Telankheri (Nagpur). The age at sexual maturity of

desi and grades of Rhode Island Red and White Leghorns were studied and it was observed that the *desi* breed on an average matured earlier than the grades. In regard to this the Animal Breeding Committee had suggested that experiments should be conducted in future to achieve early maturity in graded up progeny by intensive selection of the breeding material. The record showed a rise in egg production (in number and weight) of both Rhode Islands Red and White Leghorns in F₂ crosses over the *desi*. Simple grading without any selection of birds based on egg size has increased the average egg size of both the grades by about one third over that of the *desi*. It was estimated that if the cultivator maintained one graded hen instead of one *desi*, on an average he would get Rs. 6-4-0 more per bird per year from eggs alone. Hatchability of eggs from *desi* and grades of White Leghorns and Rhode Island Red under natural and artificial incubation showed that it was 10 per cent more under natural conditions. Efforts were made to find out ways and means to reduce chick mortality. An improvised hay-lined basket is being devised to provide uniform heat to brooding chicks in winter. One hundred and fifty cocks of improved breeds were distributed in the four rural experimental units. In the rural area 56 per cent of the total production of eggs is consumed in the villages. The staff made frequent contact with the people who were impressed with their work.

Graded stock and eggs fetched higher prices than the *desi*, graded eggs fetching one-half anna more per egg than the *desi*.

Preliminary experiments indicate that mango-seed kernel can be used as a substitute for wheat bran in feed. The work is in progress.

Duck breeding. In order to make researches on different aspects of duck rearing, schemes on duck breeding have been taken up. A scheme has been sanctioned for Travancore-Cochin, one of the largest egg producing tracts. A scheme sanctioned earlier for Bihar commenced working in December, 1950. Its technical programme is intended to cover good rearing, feeding with material other than cereals and removal of smell from eggs.

Defertilization of eggs and improved packings. The Animal Husbandry Wing of the Board of Agriculture at its meeting held at Izatnagar in March, 1951, recommended that suitable facilities be provided for grading and marketing of eggs especially in surplus areas and defertilization centres be set up where necessary. These recommendations were communicated to all the State Governments, Central Institutions, etc. In response the Central Agricultural Marketing Department prepared a scheme in consultation with the Government of Travancore-Cochin.

The objects of the scheme are :

- (i) to defertilize eggs in order to prolong their keeping qualities in summer months, so that they could be exported from surplus areas of production ; and
- (ii) to try improved methods of packing in order to reduce losses due to breakages during transhipment.

The scheme has been sanctioned for a period of 8 months and is expected to commence working during the next year.

DAIRYING

Enquiry into Fats, Solids Not Fats and Specific Gravity of Milk

In order to help (i) to fix presumptive standards for controlling the quality of milk and (ii) to provide the necessary knowledge regarding milk which is essential for its successful processing in the dairy industry in India, schemes to collect necessary data on this inquiry were sanctioned in Bombay, Bihar, Punjab and West Bengal. It was considered necessary to fix these standards on a Statewise basis in view of the separate State legislations that may come into force. Detailed instructions were circulated on the plan of sampling for the collection of milk samples for these schemes.

The Bihar Scheme was initiated on 1 February, 1951. A total number of 362 samples were tested during the year under report, out of which 276 were from cows and 86 from buffaloes. The average fat percentage of morning and evening milk samples obtained from cows other than those of Government Cattle Farm and *goshalas* were determined and found to be 4.64 per cent and 4.69 per cent, respectively. On an average evening samples were higher in fat contents than the morning samples by 0.05 per cent.

Punjab Scheme. The standard already fixed for the genuine milk in the State was very low as it was based upon scanty data. The investigations under the scheme showed that the quality of milk produced in South-East Punjab was superior as compared to other parts of the State. The standard tentatively recommended for the genuine milk now was,

	Fat%	Solids not fat%	Specific gravity
Buffaloes	6.5	9.50	1.0300
Cows	4.5	8.25	1.0290

These were based on a rapid enquiry and would be checked up on the basis of a detailed enquiry just concluded. Similar schemes are in progress in West Bengal and Bombay.

Combined Bacteriological Scheme—Indian Dairy Research Institute

Thermoduric organisms in milk. Some form of heat treatment of market milk is essential to prolong its life as well as to destroy the disease-producing organisms. The efficiency of heat-treatment and the subsequent keeping quality of milk are governed by the numbers and types of heat resistant micro-flora occurring in milk which in turn depends upon the conditions of production and handling of milk. A scheme for carrying out comprehensive investigation on the incidence and distribution of heat-resistant microflora in milk produced under different conditions in the typical regions, namely, Bangalore, Bombay and Mathura was sanctioned in 1950. Owing to financial stringency,

however, the appointment of staff was kept in abeyance. The scheme was started in April, 1951, and experiments are in progress. Combined with this investigation the preparation of desiccated cultures of starter organisms and microbiological deterioration of Indian butters were also under study.

Quality Improvement of Milk and Milk Products and Its Costing

This scheme which was working at the Allahabad Agricultural Institute since 1 April, 1947 came to a close on 31 March, 1952. During the year 382 samples of raw and fluid milk were taken for testing. The samples were drawn from each of the three daily milkings during the seasons, viz. summer, monsoon and winter. Observations including tests were made on 23 lots of milk-products such as *dahi*, butter, *cheddar*, cheese and ice-cream. The main factors tested were acidity, fat, keeping quality, etc. The tamper-proof delivery-can suitably modified was successfully put to field trials. Work on the development of a suitable cycle milk delivery unit was continued and the two-wheeled trailer type cycle delivery unit was converted into rickshaw type.

A simplified method of costing of milk was developed for the use of commercial dairies.

A final report is under preparation.

Milk costing. Preliminary arrangements were made to initiate a pilot scheme in Delhi and New Delhi municipal areas with a view to ascertaining the cost of milk production in terms of physical factors, the goods, and services consumed such as labour, feed, etc. for the maintenance and handling of the producing animals.

Scheme to Test Certain Important Standard Methods for Analysis of Milk and Milk Products and to Determine Standards for Sediment Test in Milk.

In 1946 the I.C.A.R. appointed a special committee to recommend standard methods for analysis of milk and milk products which could be followed throughout this country. These methods have been laid down and published in *I.C.A.R. Miscellaneous Bulletin No. 70*. Most of these methods are the standard methods recognised by the British Standard Institution, London, or the Association of Official Agricultural Chemists, U.S.A. There are, however, a few methods important for routine analysis of milk and milk products which have to be tested under Indian conditions. A scheme was accordingly sanctioned to test these tentative methods and to suggest such modifications as may be necessary in these. Each of these methods will be tried out at five centres in different parts of India, viz.

- (i) I.D.R.I., Bangalore
- (ii) All-India Institute of Hygiene and Public Health, Calcutta
- (iii) Allahabad Agricultural Institute, Allahabad
- (iv) Aarey Colony, Bombay
- (v) The Veterinary College, Patna

The scheme also aims at laying down suitable standards for interpretation of results on sediment test of Indian milk and to define standards for different qualities of milk on the basis of the sediment test.

Excepting for the Patna centre (which started in 1951) the scheme started early in 1950 in other centres and is due to terminate by August, 1952. The reports from the different centres will be consolidated by the Director, I.D.R.I.

Standardising Certain Methods for Analysis of Ghee

A few tentative methods for *ghee* analysis recommended by the Dairy Science Committee, were proposed to be tried out at seven different centres in the various parts of the country. Reports from each centre were to be consolidated by the Director, Dairy Research and on the basis of this report it would be eventually laid down whether these methods should be adopted as standard methods.

As a part of the study, *ghee* samples collected from Kathiawar were also analysed at four centres for the determination of Reichert and Titre values as these were required by the Director General, Health Services, for fixing standards for Kathiawar *ghee*. The report has been received and is being statistically analysed.

The scheme terminated during this year and the final report is under preparation.

Glyceride structure of ghee from oil-cake or seed-fed buffaloes. A scheme of research submitted by the Indian Institute of Science, Bangalore, on the glyceride structure of *ghee* from oil-cake or seed-fed buffalo in order to determine its variation with normal, and comparison, against adulterated *ghee*, was sanctioned with effect from 1 April, 1950. Samples obtained so far have been analysed and the scheme will terminate shortly.

Improvement of Market Quality of Ghee

With a view to standardising physical and chemical factors arising out of the conditions of manufacture of *ghee*, deciding its grain structure and aroma, and gathering further knowledge regarding the handling of raw material, the technique of manufacture and conditions of packing and storage, in order to improve the market quality of *ghee*, a scheme was started at I.D.R.I. During the year under report studies on granulation and texture of *ghee* showed that the size of the grain was not materially affected by mode of filling, whereas it was dependent on shape and size of tins, varying directly with the capacity. The effects of remelting and agitation at 100°C. produced variable results. In 75 per cent of the cases the size became smaller at the end of a storage period of three months.

In the attempts made to remove the rancid aroma often accompanying the high-acid *ghee*, alkali-treatment of high-acid butter was as ineffective as similar treatment of high-acid *ghee*. The aroma producing components were found to be destroyed by the alkali-treatment; if the neutralised butter melt is heated upto the desired temperature along with the added solids-not-fat of fresh butter either in the form of top scum and/or bottom layer of butter-milk serum, a final product emerges possessing not only the highly agreeable *ghee*-aroma but also showing a longer-keeping quality than the neutralised high-acid *ghee*.

A large-size commercial type model clarifier of butter melting with a capacity of about 220 lb. was designed to work on the principle of pre-stratification process. The clarifier could be heated by any type of fuel, such as fire-wood, charcoal or soft coke. Semi-large-scale trials at Bangalore and large-scale trials at Tirupur in Madras State were carried out with this as well as the small model household type designed last year to assess the value of new technique against the usual method of direct heating. The use of either model resulted in saving in time of manufacture, cost of fuel and labour as compared to direct heating in *karahis*. The initial market quality and subsequent keeping quality did not differ when samples from the small model were compared with the direct heating samples. In the case of the larger clarifier, the initial market quality was that the *ghee* made by direct heating had a relatively richer aroma than the one made by pre-stratification process. After three months the storage quality of the two did not show any marked difference from the original appraisal. The effect on keeping qualities by different modes of filling and sealing and by packing in containers of different sizes, types and shapes were studied. Irrespective of the method of preparation and size of packing, *ghee* samples packed in old tin gave a lower score of aroma and flavour than those packed in new tins. The keeping quality of *ghee* from high-acid butter under certain conditions of packing may be slightly poorer when prepared by pre-stratification process than by direct clarification. Further studies are in progress.

The scheme has been extended to complete the different aspects of study already under investigation and also to study the effect of the production ration, particularly with reference to cotton seed feeding on the storage property of *ghee*.

ANIMAL NUTRITION

Indigenous Grasses and Leafy Fodders

A scheme is in force since 1944 at the Indian Veterinary Research Institute with the object of determining the value of indigenous grasses at the flowering stage and leafy fodders at a stage in which they are mostly required to be fed to livestock. During the year investigation was extended to study the nutritive value of *Imperata cylindrica* grass hay, eight species of leafy fodders and *kudzu* vine.

The nutritive value of *Imperata cylindrica* hay in early green stage is found to be superior to that of hay in flowering stage. It forms a good maintenance ration alone in early green stage and in combination with wheat *bhoosa* and rape cake in flowering stage.

Bans (*Bambusa*) leaves can form a maintenance ration for sheep and *sandhan* (*Ougeinia dalbergioides*) leaves fed alone can form a maintenance ration for bullocks. The *sain* (*Terminalia tomentosa*) leaves become unpalatable when approaching shedding stage and should not be fed as a single feed. The leaves of *dhuri* (*Zizyphus rugosus*) are unpalatable and have low consumption of dry matter and low digestible crude protein. Therefore supplementation with food concentrate and roughage appears desirable. *Pakar* (*Ficus infectoria*) leaves were not found satisfactory even on combination.

Kudzu vine (*Pueraria hirsuta*) is a perennial leguminous vine rich in protein and phosphorus as compared to *berseem* (*Trifolium alexandrianum*) and in calcium content compares favourably with it. *Kudzu* hay was fed to adult goats, and it was found that digestible protein of *kudzu* hay was higher than that of cowpea (*Vigna sinensis*) and *berseem* hays and compared favourably with wheat bran. Starch equivalent value was lower than those of legume hays and approximated to some of the grass hays.

Under the Sheep Nutrition Scheme at the I.V.R.I. a systematic study was made to determine the dietetic requirements that were necessary to maintain lambs in health and optimum growth. Experimental lambs were fed proteins at various levels ranging from 0.03 to 0.07 lb. digestible crude protein per 10 lb. live weight, and it was found that the growth rate was maximum at 0.05 lb. level. A study of the calcium phosphorus and nitrogen balances at different ages and with different levels of intake of digestible crude proteins has also shown that at all ages 0.05 lb. group retained these elements best. For example, at the age of three months retention in this group was slightly better than the group fed with 0.03 and 0.04 lb. of digestible crude protein. It still increased at the age of five months in 0.05 lb. group but in the 0.03 lb. group the balance for nitrogen and phosphorus was poor and negative for calcium. The retention was double at the age of $6\frac{1}{2}$ months in 0.05 lb. group as compared to 0.03 lb. group. Similar trends were observed in later ages.

In morphological and chemical studies of blood of sheep no difference was found upto the age of four months in feeding different levels of digestible crude protein but at the age of 4-5 months when the animals had been on experimental diet for the two months, those in 0.05 lb. digestible crude protein group, had comparatively higher values of the red blood corpuscles, haemoglobin, cell volume and serum protein. Feeding of higher level of proteins had no effect on the above blood constituents.

Feeding Experiments with Vitamin A

A study of the effect of feeding inadequate quantities of Vitamin A to pregnant sheep and the newly born lambs was made. Young animals on inadequate diet showed typical symptoms of avitaminosis 'A' like stunted growth and poor skeletal development, dullness, in-co-ordination of movement, loss of sexual vigour, and in advance stages xerophthalmia, opacity of the cornea and sometimes blindness. Contrary to this, animals kept on ample supply of vitamins had marked increase in weight and growth. There was practically no difference in the blood constituents of the two groups except that in animals given inadequate vitamin 'A' the number of the white blood cells was increased. In early stages there was also no difference in chemical constituents of blood in both the groups but in advance cases calcium content was reduced and phosphorus was increased.

Effects of Hormones in Relation to Induced Lactation

A scheme to study the metabolic effects of hormones in relation to induced lactation has been sanctioned for investigation at the U.P. College of Veterinary Science and Animal Husbandry, Mathura. As there are large number of uneconomic and sterile animals in the country, the object of the scheme was firstly to induce lactation by hormonal treatment in dry and sterile animals artificially and thus make them useful and economic. The effect of hormones on body metabolism and food digestion would be studied as milk production was directly dependent on this factor. Such information would help to formulate a balanced ration for animals under hormonal treatment. Secondly the optimum dosage of hormones that would be necessary to induce simultaneously lactation and sterility, so that further production from such uneconomic animals may stop, would also be investigated.

Regional Centres for Animal Nutrition

In pursuance of the Council's policy to start Regional Centres for Animal Nutrition, the first centre was inaugurated by Shri K. M. Munshi, Minister for Food & Agriculture, at the Institute of Agriculture, Anand, in January 1952. The centre for the Southern Region will be located next year at the Indian Dairy Research Institute, Bangalore. The work at these centres will be co-ordinated by the Animal Nutrition Division of the Indian Veterinary Research Institute.

Due to delay in recruitment, etc. the schemes on trace elements and on degeneration of cattle in humid climate at the Indian Veterinary Research Institute could not be initiated.

ANIMAL HEALTH

Disease Investigation Schemes

Disease Investigation Schemes for cattle, sheep and goats and poultry were continued in the various States. Most of the disease

investigations have been taken over by the respective State Governments but their progress reports and technical programmes still continue to be co-ordinated by the Council. In pursuance of its policy to treat India as one unit in the matter of disease investigation new Disease Investigation Schemes have been sanctioned for the States of PEPSU, Madhya Bharat and Saurashtra and Kutch (combined), the Council's share being 50 per cent of the expenditure. Similarly the Assistant Disease Investigation Officers (Sheep and Goats) Schemes for Bombay, Madras, Orissa, Punjab and Mysore have been extended up to 31 March, 1954, after which the schemes are expected to be taken over by the State Governments concerned.

Rinderpest. The 'Pilot Scheme' which was sanctioned as a forerunner to the all-India plan of complete eradication of rinderpest from the country by the use of lapinised vaccine started functioning at the I.V.R.I. Under this scheme large-scale vaccination of cattle, buffaloes, sheep and goats under field conditions is contemplated and it is intended to test the nature and duration of immunity produced by this vaccine. Accordingly a large number of animals were vaccinated in the States of Punjab and Madras.

Rinderpest was also investigated in Jammu and Kashmir, Bihar, Madhya Pradesh, Madras and Orissa during the year. In the Punjab as a result of vaccination 15-17 per cent drop in the milk yield was observed for a period of 5-6 days only and normal yield was restored 10-11 days after the vaccination with 'Goatis'. In other States viability of different vaccines and the immunity produced was studied. In Madhya Pradesh the 'Desiccated' vaccine was found to be viable in 1 : 300 dilution upto three weeks, after three weeks storage at 5°C. The vaccine, however, lost its antigenic properties after three weeks storage in refrigerator at 5°C and then for one week in the incubator at 37°C. During November 1950 to May 1951, virus kept in ampoules at room temperature for ten days proved antigenic and has been tested for viability in a dose upto 1 c.c. of 1:500. As a result of experience in Madras it was believed heretofore that the Madras strain of rinderpest goat-adapted virus was too virulent and could not be used alone and required the use of antiserum. A study to compare the Madras and Mukteswar strain was, however, made on buffaloes. Though no untoward reaction was observed in both the cases, thermal reaction was more marked with the Madras strain. This finding confirmed the higher virulence of the Madras strain which has therefore been substituted by the Mukteswar virus. In Orissa, breakdown of immunity occurred after vaccination with 'Goatis'. In Punjab no difference was found in the effect of 'Goatis' and 'Desiccated vaccine' when these were used fresh and after storage at different intervals.

Mastitis. In view of the wide prevalence of mastitis in Indian cattle and its importance to the dairy industry and public health, the Council sanctioned two more centres, one at the I.V.R.I. for purposes

of co-ordination of research and the other in the Punjab in addition to the existing centres at Bombay and Mysore. The object of all these schemes was to determine the extent of the prevalence of the disease by suitable diagnostic procedure to find out the relative importance of different organisms involved in the causation of the disease, and to determine the efficacy of the different chemotherapeutic agents. In Mysore and Bombay, large number of milk samples were examined by bacteriological and cultural examinations. In Mysore, contrary to the results obtained in other countries, *Staphylococci* was generally found to cause chronic form of mastitis in addition to the acute type. The significance of this finding is being investigated further.

Foot and mouth disease. The scheme for typing the various strains of virus and evolving a suitable vaccine against the foot and mouth disease continued to function after I.V.R.I. Six viable strains from the field outbreaks were typed by cross immunity tests in guinea-pigs. In all 67 Indian field strains have been isolated and typed so far. The typical strain isolated in 1944 in the Punjab continued to maintain its character. During the year under report two brews of crystal violet vaccine were prepared and its comparative efficacy was studied with the 'Gel' vaccine received from Copenhagen. The type of local reaction in both the cases was identical. In immunity tests some of the animals vaccinated with 'Gel' vaccine (bivalent 'O' & 'A') reacted either against one or the other type thus showing that the immunity conferred by this vaccine was not solid while those vaccinated with crystal violet vaccine (Bivalent 'O' and 'C') had acquired a solid immunity. The immunity conferred by the crystal violet vaccine (Mukteswar) is of a superior order to that of the 'Gel' vaccine (Copenhagen). Certain proprietary drugs claimed to be effective both as curative and preventive for foot and mouth disease were found to be of no avail under controlled conditions. This scheme has been further extended for a period of three years; for preparation of the vaccine a part of the scheme was proposed to be transferred to Madras temporarily.

Brucellosis—contagious abortion. This was investigated in Bihar, Bombay, Madhya Pradesh and Madras. In Bombay, the disease has been found to be rather widely prevalent in practically all the districts of the States. It was found to exist in practically all the Institutions supplying the large quantities of milk. On agglutination test 20.2 per cent and 13.1 per cent positive cattle and buffaloes were detected. Hygienic measures were adopted and calfhood vaccination was resorted to in badly affected farms, dairies and *gowshalas* with promising results. In Madhya Pradesh, 1874 samples of blood sera from bovine animals from Government Farms and Key Villages were subjected to 'Quick Agglutination' test. Positive and doubtful reactors of this test and all cases of abortion were tested by slow tube agglutination method and 212 and 62 samples were found to be positive and

doubtful reactors respectively. Control of the disease at the Government farms and dairies is being effected by annual testing of herds and *ad hoc* testing of all cases of abortion and segregation of positive and doubtful reactors. Vaccination with *Brucella* strain 19 vaccine gave encouraging results in Madhya Pradesh and Madras. In the latter State animals were tested at 10 new centres and heavy infection was noticed in Nellore district. Incidence of *Brucellosis* was observed to be very high at Khapuria-Dairy farm in Cuttack in Orissa State. At this farm there were more abortions in buffaloes than in cows. Serum from such animals was positive on agglutination test. The incidence of the disease was also surveyed in the villages of Sambalpur and Cuttack districts. In the Punjab, the survey for the disease was undertaken in all the districts and at the Government Livestock Farm, Hissar. In the Animal Genetics Section of the Farm 9.6 per cent animals aborted, most of which gave positive reaction. Material from aborted foetus was, however, found negative on cultural and biological tests. None of the suckling calves from the positive dams was found to contract the disease. Between one and two years of age the infection was lowest but it progressively increased with the age, being heavy in cows above 4.5 years and milch and pregnant cows. However, in the field survey only seven cases out of 251 animals tested were found positive to the test.

Tuberculosis. At the I.V.R.I. the Council's scheme for the investigation of T.B. and Johne's disease continued to function. The schemes have been extended for a period of three years. During this year 42,500 doses of concentrated synthetic tuberculin were prepared. Typing of tubercle *bacille* from human sputum was again taken up, but all the samples received were found negative. Tuberculin testing of cattle and buffaloes was undertaken under this scheme and the Disease Investigation Schemes in the States.

Observations regarding the incidence are tabulated below.

Place	Number of animals tested	Number positive	Number of doubtful reactors	Percentage
I. V. R. I. Izatnagar	177	7	..	4.0
I. V. R. I. Mukteswar	68 adults	1	1	..
	65 young stock	..	..	..
Cattle Breeding Station, Jabalpur.	399	1	..	0.25
Kashmir	170	12	4	..
Mysore	13	2	3	9.6
Bombay	809	79	..	10.1
Punjab	95	11	..	11.5

Milk sample tested in Bombay from four positive reactors were found negative. Incidence of T.B. was also studied in the sheep and goats in Bombay and Poona. Percentage of positive and doubtful reactors in Bombay was 6.6 in goats, 3.7 in sheep; in Poona it was 6.39 in sheep. In Mukteswar, incidence was 13.5 in goats and nil in sheep.

Johne's disease. Four thousand, two hundred and fifty doses of Johnin were prepared at the I.V.R.I. during the year. Cattle, sheep and goats were tested against Johne's disease by intradermal method using Johnin. Out of 158 goats and 15 sheep at Mukteswar 9 per cent reacted positively or doubtfully; all the sheep being negative to the test. In a similar test at the Sheep Breeding Farm, Guttal 2.2 per cent goats and 3.7 per cent sheep were found positive or doubtful, while 3.7 per cent sheep were positive at Poona Farm. At Hosur Farm nine cattle out of 620 gave positive reaction, 65 young bovines at Mukteswar reacted negatively but at Izatnagar one doubtful reactor in 177 animals was detected.

Disease caused by anaerobes. The scheme for the investigation of diseases of animal caused by anaerobes continued to function at the I.V.R.I. and has now been extended for a further period of three years. A large number of strains of anaerobic organisms that were isolated this year and in the previous year were purified and their biochemical characters were studied by different methods. During this year 12 strains of anaerobes were isolated using cultural and biological methods from the black quarter disease material received from the field and their fermentation reaction was studied. Serological relations of strains were also studied. Work on agglutination test is in progress. The role of *Clostridium welchii* in the causation of enterotoxaemia has been investigated but no conclusive results were achieved.

Diseases of sheep and goats

The various A.D.I.O. (sheep & goats) undertook further survey of the common contagious diseases of sheep and goats in their respective States and information relating to incidence, symptoms, mortality, etc. was recorded.

'Pitto' and 'Gillar'. This disease was encountered in Bihar and Bombay. In Bihar regular drenching with anthelmintics and adoption of preventive measures like closing of low-living pastures, burning of pasture during summer and destruction of snails helped to control the disease. Tetrachloroethylene gave good results in Bombay.

Contagious caprine pleuro-pneumonia. In Bombay, culture vaccine was found to give satisfactory results to control the disease and this confirmed the results obtained in the previous year. In Mysore, however, under village conditions encouraging results were obtained by the formalised lung tissue vaccine. Outbreaks of this disease also occurred in Orissa and these were believed to have been imported through *Beetal*

stock that was purchased from the Punjab. As a curative N.A.B. was found to give good results in Orissa and Mysore.

Encephalomyelitis. In Punjab, prophylactic vaccination against this disease was done in 83 goats and 23 lambs with 4 per cent carbolised emulsion of the brain substance of an affected animal but it was found ineffective. For treatment of affected animals in Punjab encouraging results were obtained by administration of Vitamin B. Feeding trials further showed this disease to be of nutritional origin. In Orissa, treatment with copper sulphate and ferrous sulphate gave encouraging results.

Enterotoxaemia. This disease occurred in Mysore State between the months of September to January and resulted in appreciable mortality. On post-mortem, material cultured was positive for the *Clostridium* fast anaerobes.

Rinderpest. A number of severe outbreaks of rinderpest occurred exclusively in sheep and goats in Mysore and resulted on heavy mortality. Cattle and buffaloes in close vicinity remained unaffected. In Punjab, however, sheep and goats got the disease in conjunction with outbreaks in bovines. Prophylactic vaccination suppressed the disease. At the Hissar Farm, sheep and goats were immunised with lapinised virus. No difference in reaction was found by immunization of sheep and goats by subcut or scarification method. Animals vaccinated in 1948 were found to have solid immunity after two years, except in the Bikaneri sheep where it was variable. In Bombay, the disease has been found to be more virulent in goats than in sheep. Lambs and kids were, however, the worst sufferers. Vaccination with serum simultaneous method gave satisfactory results.

Sheep and goat pox. This disease was investigated in a number of States. In the Punjab vaccination of young lambs and kids was done with both the I.V.R.I. and Mysore vaccines. Both of these gave no thermal reaction, but showed a well defined local reaction. Addition of Streptomycin to vaccine eliminated the bacterial contamination in the vaccine, without impairing the viability of the virus. Such treated vaccine has been found to be potent even beyond five months. Two kinds of sensitized vaccines were prepared in Mysore and these were found to be superior in many respects to the non-sensitized vaccines. Attempts to cultivate sheep-pox virus on membranes of the chick embryo proved futile. Similar efforts made to grow the goat-pox virus were also without success.

Rickettsiosis. This disease was again confirmed in clean animals in Bombay State and the casual agent *Rickettsia* bodies were seen in the blood of these animals. The disease could be transmitted to guinea pig by inoculation of infected blood. Strain of *Rickettsiae* recovered in Bombay, however, appear to be different from those detected in Africa.

Co-ordinated Schemes on Helminthiasis

The livestock helminthic infestation schemes continued to function at the I.V.R.I., Veterinary College, Madras and Calcutta and at Lucknow University. The scheme for the helminthic parasites affecting poultry at the I.V.R.I. has been extended for a period of one year. The Madras scheme terminated on 31 March, 1952.

Under the I.V.R.I. scheme further studies about the life history of *P. bovicola* were made. A method has been developed for breeding and rearing clean flies in the laboratory. In a study of the part played by these flies in the life history of the parasite a first stage filarid larva was obtained from the abdominal haemocoel of the fly 44 hours after infection. A series of the developmental stages of filarid larvae were recovered from flies captured while feeding on oozing blood of affected animals. Experiments to infect laboratory bred snails with miracidium of *S. indicum* were unsuccessful. Incidence of natural infection of snails with cercaria of *S. indicum* was found to be low during the year. Among kids, lambs, rabbit, guinea pig, white rat, monkey and fowl all except last three were found to be capable of infection with cercariae of *S. indicum*.

In Madras, observations were made on certain epidemiological aspects of the life history of *A. vitulorum*. Bright light has been found to cause death and degeneration of embryos. Observation made so far on this parasite indicate that older calves and adults are not infected by two biological strains of the worm probably exist and that calves may be infected in the uterus. A previous infection may enable an animal to resist second infection. *Galuna* species of mite has been found to be another vector of *Moneizia benedeni*. It has also been observed that a single mite can harbour as many as 15 cysticercodies in the various developmental stages. Ecological studies on the Limnae and Indoplanorbis snails have been made. The feeding and locomotive habits of both these have been studied. Agroxone was tested and it was found to be effective as in about a week's time all the weeds had wilted, curled and bleached but the grasses remained unaffected. Biological control of snails by feeding on certain plants was tried with encouraging results. Among these plants Acacia was the most toxic. A study of the host parasite relationship was made and host specificity of *Haemonchous contortus* was established.

In Bengal, role of arthropod vectors in transmission of *Stephanofilaria assamensis* was studied. It was possible to infect clean flies by feeding on affected animals.

Under the Poultry Helminths Scheme at the I.V.R.I. natural resistance of birds to worm infestation was studied and it was observed that deficiency of vitamin A and calcium in the poultry diet render the birds highly susceptible to the *A. galli* infection while in deficient protein diet, resistance was reduced only indirectly due to low body

condition Vitamin D has been found to play no role in increasing or decreasing the resistance so far as worms are concerned. Deficiency of calcium and vitamin A in the diet also increased the worm egg count in the faeces.

Investigations on the control of different parasites of cattle, sheep and goats were also carried out in the various states. In Kashmir, work on *Fasciola* was continued and Hexechloroethane was found to be very effective to control this. The effect of the drug was found to start from the posterior end of the parasite. Copper sulphate administration in daily doses of $1\frac{1}{2}$ —2 grains to cattle has been found to be effective to prevent *Fasciola* infection. Irrigation of fields with copper sulphate, 1 in 5 to 7 lakhs concentration, was effective to kill snails. Haemonchosis in Bombay Sate was controlled effectively by administration of phenothiazine.

In Madhya Pradesh considerable mortality in buffalo calves occurred in Government Dairy Farms due to *Ascaris* infection. In such cases treatment with copper sulphate was found to be superior to drenching with oil of turpentine, etc. This has been adopted as routine along with hygienic measures and disinfection. In the Punjab, copper sulphate and *kamala* was administered with success to eliminate strongyle worms in sheep. Mixed infection of Haemonchosis and Coccidiosis was also detected in sheep in the Punjab. In Madras, sheep and goat mortality due to helminthic parasites was controlled by the administration of phenothiazine in one centre and copper sulphate and mustard in the other centre.

Indigenous Drugs in Veterinary Practice

The scheme for the collecting and collating information on indigenous drugs used in veterinary practice from the available ancient literature and Sanskrit manuscripts continued to function in Madras. Under this scheme a large number of ancient books on the subject have been consulted from important libraries in South India and a large number of useful prescriptions on cattle diseases and selected portions of literature pertaining to diseases were translated. To facilitate reference a detailed glossary of large number of indigenous herbs and plants referred to in the literature with their equivalent English, vernacular and botanical names have been prepared and an index of all the vernacular names has been appended to it.

The second scheme on use of indigenous drugs by village practitioners in veterinary practice continued at the headquarters of the Council. In this scheme about 800 useful prescriptions of indigenous medicines actually used by the village practitioner and in some Veterinary Hospitals in Northern India were collected and collated.

Both the schemes terminated during the year and on recommendations of the Animal Diseases and Pests Committee a sub-committee has been appointed to sift the prescriptions so collected and recommend the suitable ones for trial under controlled conditions.

Animal Health Information Service

The Council initiated an Animal Health Information Service in 1947 with the object of providing latest information to the States and other countries regarding prevalence of important diseases of cattle, horses, sheep, goats and dogs. This was done with a view to help in giving timely warnings and adopting control measures against the ingress of contagious diseases from the bordering States and countries. This information is compiled in the form of monthly bulletins from statistics supplied by the District Veterinary Officers under heads such as incidence, location, number of animals attacked and mortality from contagious diseases. These bulletins are being regularly issued free of cost to all the Directors of Veterinary Services and Animal Husbandry Departments, Principals of Veterinary Colleges and Heads of Central and State Research Institutes in India. In addition these are also sent to many foreign countries. So far 55 bulletins have been issued.

Recently three yearly statements have been compiled and an interpretation of the data is under progress.

Hides and Skins

In a study of the bionomics of the common cattle tick, it has been observed that there is a marked fluctuation in the intensity of tick population due to the change of weather and also due to different condition of the soil moisture on the pasture. Extreme cold weather is found to considerably shorten the normal duration of infestation of ticks. Comparatively, engorged female ticks are found to be more resistant to extreme fall in temperature than the ticks in the larval nymphal and unengorged adult stage. Engorged ticks that have deposited some eggs have been found to be much more readily destroyed by severe cold than those that have not laid eggs. During winter, therefore, infestation of fields and pastures with ticks may be greatly reduced, and in times when temperature falls to zero the entire tick population may perish. These observations are considered to be significant for whole of the Northern India, where tick infestation is heavy. Geographical survey of ticks in U.P. showed that *Rhipicentralus haemaphysaloids* were rare in this State. Majority of specimens have been found to belong to the *Hyalomma aegyptium* species, next to this being *Boophilus microplus*. However specimens from Bombay and Madras revealed a medium infestation of *R. haemaphysaloids* indicating the effect of climatic factors like temperature and humidity on varied distribution.

A study of bionomics of *Hunterellus hookeri*, a parasite of the tick, showed that in about 70 per cent. cases the tick was found to be parasitised in nymphal stage. It was also observed that *Hyalomma aegyptium* and *Boophilus microplus* the two most common species of ticks were parasitised to the extent of 40 and 25 per cent respectively.

A number of tickicidal drugs were tried. Gamatox paste dip found to be effective in the form of dip but as a spray was expensive and uneconomical. To avoid use of a solvent for making a solution of D.D.T., a 0.5 per cent. D.D.T. soap water emulsion was tried as a spray and for hand dressing but it had no appreciable effect on ticks. Mosquitox, another acaricidal drug was also found to be uneconomical. Hexidole—950 gave 95 per cent tick mortality and the treated animals remained tick-free for over a fortnight thus showing its high residual effect. This drug was therefore found economical. Torch Brand *Kitkari* was another drug that was tried. The scheme at I.V.R.I. on research into damage caused to hides and skins has been extended for a period of three years.

Research Fellowships in Animal Husbandry and Dairying

Recognising the general paucity of qualified personnel in the various branches of animal husbandry, the Council had sanctioned scholarships each of two years duration in Animal Pathology, Animal Bacteriology, Animal Physiology, Animal Parasitology [(i) Protozoology and (ii) Helminthology] and Animal Genetics at the I.V.R.I. Applications were invited from all over India and a Selection Board was constituted to select the candidates. Four of the scholars joined towards the end of the year and the fifth is expected to join shortly.

Another scholarship was sanctioned this year at the I.D.R.I. for training in Dairy Bacteriology.

APICULTURE

Bee Research Station, Punjab, Katrain. Some desirable strains of *Apis indica* have been selected and biometrical studies conducted. Important observations on the bionomics of the bees colony, number of queen cells, time of swarming, weight of swarm, total capacity for brood rearing, pollen collection, etc., have been made. Evaluation of the part played by honey bees in the pollination of turnips, carrots, cabbage, beet-root and apples have been under way. Quantitative analysis of other insect pollinators of different crops during various parts of the day have been made.

Improved management practices for increasing honey yield per colony and control of bee enemies have been worked out and valuable data on migratory bee-keeping obtained. A large number of Punjab honey samples have been chemically analysed. Sugar concentration of various nectars secreted by different plants as influenced by varying climatic factors have been worked out.

The station has been converted into Regional Centre for Bee-research in the North with effect from 1 April, 1951.

The Southern Centre commenced working at Coimbatore with effect from 5 December, 1951.

FISH AND FISHERIES

Rural Piscicultural Scheme, Madras

During the year additional data regarding the biology of fishes was collected. Information about 40 species was available. Experiments on acclimatisation and transport of live fish have been carried on a number of species. Some of the factors studied were the use of oxygen tin carriers, their transport by air and method of aerating water in these carriers. Preliminary trials with the addition of juice from banana stems and ant-hill earth in live fish transport were also conducted. Detailed studies on fish diseases and mortality were reported from a number of ponds and tanks; the causes were investigated and remedial measures suggested. Addition of jaggery (*gur*) was found to be harmful to fish life. One per cent concentration of jaggery proper or 0.002 per cent of the saponin was found sufficient to kill fishes like *Labeo fimbriatus* and *Barbus sarana*, 2 to 3 inches in size.

The possibility of utilisation of effluents of the sewage farm was investigated from which it was observed that effluent was conducive to the growth and breeding of fish. Carps appeared to spawn ordinarily in all the South Indian rivers during floods at all times of the day or night at the beginning of south-west or north-east monsoon season or both.

A good deal of further useful observations recorded relate to the hydrobiological condition of several waters in Madras State. These observations are important from the point of view of fish culture. Already extension work has been started at a number of places based on the results of the scheme.

The scheme after a successful run for about 10 years has been taken over as a permanent feature of the Madras Fisheries Department with effect from 1 April, 1952.

The Rural Fishery Research Scheme, Annamalai University

The scheme was initiated on 20 September, 1951. The scheme is still in its initial stages but a considerable amount of useful work, though mostly of a preliminary nature, has already been done. The work has been well planned and progress up-to-date is regarded as satisfactory. The investigations concern with the seasonal cycle in the gonads and the reproductive cycle of three out of the five species of fish included in this scheme. Data in connection with the seasonal variations of the 'condition factor' of the gonads has been correlated with histological changes in the tests and ovaries of *Ophicephalus striatus*, *Cirrhina reba* and *Labeo fimbriatus*. These changes have also been correlated with the size and histology of the pituitary gland of *Cirrhina reba* and *Labeo fimbriatus*. Work has also been initiated on the effects of human gonadotrophin on *Ophicephalus striatus*.

Animal Pests of Stored Fish, Travancore University

Dermestes ater and *Lardoglyphus* are the predominant pests of dried fish causing damage to the cured products.

Dried fish is not generally stored in godowns throughout the year. During the off season when godowns are empty, the adults of *Dermestes ater* live in some crevice or hole in the dried fish waste dumped in the neglected corners of the godown. The hypopal phase of *Lardoglyphus* is specially adapted for tiding over such unfavourable season. These hypoi usually attach themselves below the second pair of wings of *Dermestes* during the unfavourable season.

It has been found that moisture content of dried fish was a vital factor responsible for infestation. *Lardoglyphus* has been found to thrive well in a moisture content of 16-18 per cent. *Dermestes ater* thrived well in dried salted fish with a moisture content of 14-20 per cent. From preliminary experiments it was found that *Stolephorus* dried for two days in the open sun and prawns dried for three days under normal temperature had greater keeping quality. Boiling of prawns in 7 per cent brine was also found to enhance its keeping quality.

CHAPTER IV.—DELHI DEVELOPMENT SCHEME

GENERAL

This is the fourth year of the scheme. In addition to the establishment of the improved cultural practices and use of improved implements and seeds, the activities of the scheme embraced training of local cultivators in self-help. Distribution of all the seeds, implements and manure which hitherto was done directly was handed over to Co-operative Multipurpose Societies which were formed in nine out of ten villages. The work during this year was directly under the supervision of the staff under the scheme in order to ensure the correct distribution and to train the local societies in seed store management. The work was done satisfactorily and it is expected that next year the societies will be able to look after themselves without external help.

AGRICULTURE

Improved Seed Distribution

Improved seeds were distributed as indicated below :

1. Wheat 2,000 maunds
2. Gram 3,500 maunds
3. *Juar* 2,000 maunds
4. Potato 36 maunds
5. Sugarcane 50 maunds
6. Vegetable seed 184 lb.

Introduction of New Crops

Moeng T.I. which was introduced in 1950-51 was not taken up by cultivators on large scale, because the rains were very late and scanty.

The gram T-87 gave a better yield in villages Sahibabad, Daulatpur and established there. In other villages, its yield was not significantly higher than the local varieties.

Improved Implements

Sabash plough from Allahabad Agricultural Institute is still the most popular plough. Another soil inverting light plough called 'Meston' was purchased from Messrs Cossul and Co. Kanpur, and introduced. The working of Meston plough is no doubt superior but

the share which is of cast iron breaks easily and therefore the cultivator is not in favour of this plough. It will take sometime to convince him that the ultimate cost of the shares for both of these ploughs will be the same in the long run.

Sale of ploughs during this year was 162 which is lower than last year. Total number of pair of bullocks in the ten villages was 1,050 and the total number of ploughs sold up-to-date was 990. This shows theoretically that almost all the cultivators possess soil-turning ploughs with them in addition to *desi* ploughs. This is however not the case because a sufficiently large number of ploughs sold from our store have gone out to cultivators outside the scheme's jurisdiction. It would appear that the villager has been convinced of the working of soil-turning plough.

Out of the two new implements introduced last year, demand for 'Olpad' thresher has increased. Six out of nine Co-operative Multi-purpose Societies have purchased one each and are issuing these on hire to their members. Seed-drill being a costly implement has not been purchased but there is a demand for this machine also on hire. Five new seed-drills purchased from the donations made in the U.S.A. were given as a gift to five villagers on 10 March 1952. These machines will be used on co-operative basis for sowing wheat.

Manure

The use of sulphate of ammonia and city refuse from *Badli* dumps is increasing. These are used only to raise cash crops. The practice of top-dressing wheat crop has not been established as yet. This will be tried again. Sale of ammonium sulphate was 193 maunds as against 84 maunds last year.

Horticulture

One thousand nine hundred and fifty fruit plants were directly distributed by the Council while private nurseries were responsible for distribution of almost the same number of fruit plants. The nursery under the scheme at Bawana started functioning. Six hundred fruit plants were sold from the nursery and 5,000 plants of various kinds made ready for sale.

Vegetables

Distribution of vegetable seeds from the store maintained under the scheme could be possible only to a very limited extent. This is so because the local cultivators are raising their own vegetable seeds. The seed of those vegetables which could not be raised here were sold under the scheme. The area under these vegetables being small the distribution of seeds was almost negligible, i.e., 184 lb.

ANIMAL HUSBANDRY

Fisheries

During the year under review only two tanks (i) Sabibad-Daulatpur and (ii) Barwala were netted; sale proceeds from these tanks worked out at Rs. 350 only. Peaching occurred in the tanks of Auchandi and Puth Khurd. The prejudices of local cultivators to the rearing of fish are gradually diminishing.

Poultry

Three cockrels and 62 hens of improved and acclimatised exotic breeds were sold to cultivators. The poultry development work in the villages was looked after by the Key Village Scheme's staff and no outbreaks of epidemic were reported. Reports of spirrochuttosis were received from two villages and these were promptly controlled.

Piggery

The one remaining Yorkshire pig which had become too heavy to cover the local small-sized sows was sent to the Central Dairy Farm, Aligarh and two sows and one boar of small-size Yorkshire breed were purchased. Nine male piglets and two female piglets were issued in these villages for breeding purposes. From the survey of the villages it was observed that the number of cross-bred pigs is increasing every year. It is expected that within a short time the breed of pigs will be completely changed.

Cattle Development

Under the Key Village Scheme of cattle development the preliminary house to house survey was completed. All undesirable males were castrated and regular recording of the milk yield was undertaken. As a result of the working of the artificial insemination centre 237 cows and she-buffaloes were inseminated. Out of these 72 per cent were found to have conceived. Prophylactic measures were taken to protect cattle against haemorrhagic septicaemia and rinderpest. No epidemic occurred during the year, in spite of the fact that sufficiently large number of cattle passed through this area from Rohtak to various districts in U.P.

CO-OPERATIVE MILK PRODUCTION AND MARKETING

A pilot project to help increase milk production in the villages and to provide good quality milk at reasonable price to the public in Delhi was started early in February, 1951. This project envisaged the production of milk on an organised basis in the villages, provision of facilities with regard to milking sheds, veterinary aid, artificial insemination, loans for purchase of cattle and concentrates at wholesale prices, collection and transport of milk and its distribution to the public in Delhi

after pasteurisation. Milking sheds had been constructed in three villages for centralised milking under proper supervision ; open air milking in central places was practised in other villages. During the year under review, loans for purchase of six milking animals were given by the Co-operative Department of Delhi State through the Multi-purpose Co-operative Societies. Ten Animals of willing producers were artificially inseminated, veterinary aid was provided to sick animals and about 2,000 md. of concentrates were supplied to the producers at wholesale prices. A beginning was made with the production of about four maunds of milk which was gradually increased to 25 md. during the flush season. There were 90 member-producers owning 92 milking cattle at the close of the year. The total surplus production made available by producers for marketing in Delhi was 6,000 md. during the year. The seasonal prices received by the producers for milk supplied by them ranged from Rs. 20 to Rs. 22 per maund and these prices were about Rs. 2 per maund more than the prices generally paid by *dudhias*.

Introduction of centralised milking in the villages was considered essential for hygienic production under proper supervision and therefore, timings convenient to the milk producers had to be fixed. In this system, milk could not be handled in raw condition as the timings of milking in the villages did not fit in with the distribution hours in Delhi. The morning production had to be sold in the afternoon and the evening production the following morning as is the usual practice in large-scale milk handling and this necessitated pasteurisation of milk before distribution. The Council could not set up a dairy of its own to start with and arrangements were, therefore, made for the pasteurisation and cold-storage of milk in a private local dairy. As it was uneconomic to take up pasteurisation work with the quantity of milk which could be obtained from the villages and also because of the increasing demand from the public, arrangements for additional supplies from other sources such as Cattle-cum-Dairy Farm, Karnal and Co-operative Milk Union, Meerut, were made.

During the year under review about 17.460 md. of pasteurised milk valued at Rs. 4.98 lakhs was sold. Supplies in bulk quantities were made to institutions such as displaced persons' home and hostels and to the public through 25 sales depots located in different quarters of Delhi.

The scheme has been making a steady progress. The private local dairy, where milk was pasteurised was not in a position to handle the increasing supply and therefore, the Council decided to set up a dairy of its own. An expenditure of Rs. 3.55 lakhs was sanctioned and arrangements for setting up a dairy are under way.

CHAPTER V.—AGRICULTURAL AND ANIMAL HUSBANDRY RESEARCH

FODDER CROPS AND PASTURELAND IMPROVEMENT

Kudzu vine (*Pueraria hirsuta* synonym *thunbergiana*) at the I.A.R.I.

Of Chinese and Japanese origin, *kudzu* vine is a very important fodder legume; its growth helps also soil conservation considerably. Though the plant was introduced in India in 1925, its wider propagation was not achieved due primarily to the lack of flower and seed formation. Attempts were, however, made at Poona during 1944-47, which proved inconclusive. Considering the importance of this useful plant in the pasture set-up of the country, the Council initiated at the Indian Agricultural Research Institute a three-year scheme from 1950 to study the environmental conditions conducive to flowering and seed setting in *kudzu* vine as also for studying the comparative performance of Indian *Pueraria* species. Some of them, such as *Pueraria tuberosa* (*Dolichos viridis*), are found in the Himalayan regions and grow wild in the Punjab where these are used for food as well as for medicine. Similarly *P. phaseoloides* (*P. javanica* Benth) is suspected to be indigenous to Bengal.

During the year studies were continued on *P. tuberosa*, *P. phaseoloides* and *P. hirsuta*. *P. tuberosa*, although it showed better growth than *P. phaseoloides* (tropical *kudzu*) compared less favourably with the profuse growth obtained in *P. hirsuta*. The indigenous collection from Assam was less vigorous than the collection from the U.S.A. In general *P. phaseoloides* did not appear to be suitable under Delhi conditions. In Delhi, earliest natural flowering and pod formation in one year and five months was observed in September, 1951, in plants transplanted on 27 March, 1950. The determining factor appeared to be the nature of the crown.

In the trial with scarified seed distributed from Delhi in 11 tracts, with the exception of Angul (Orissa), Nellore, Coimbatore and Mahabaleswar, germination was fairly good in the remaining seven centres, though dying of seedling, was a common feature except at Amakapalle, Baroda, Dharwar, and Poona where the plants showed fair growth.

However, for successful raising of plants from seeds, scarifying the seeds was found advisable; also sowing the seeds between 15 May to 7 June, and covering plants with wet gunny bags; planting of crown during January-February gave excellent establishment of plants.

Crowns and potted plants are now supplied by the Indian Agricultural Research Institute for trials in different places.

Co-ordinated Pasture Land Improvement Scheme

The Council has already taken steps to finance schemes of research on problems affecting animal nutrition and improvement of pastures. A model scheme on the improvement of pastures and legumes in India was drafted by the Council and it was circulated to all A and B State Governments in August, 1950. The scheme consisted of two parts, viz. (a) survey and collection of pasture grasses and legumes from inside and outside India and (b) improvement of pastures, grasses and legumes and their feeding trials at four regional nutritional centres to be set up by the Council, (the first one has already been sanctioned for Anand) or at any existing State Nutrition Centre. As regards the former the Director, Indian Agricultural Research Institute, was requested to draw up a scheme on the survey and collection of pasture grasses. For the other objective the State Governments were requested to forward to the Council suitable schemes on the lines indicated in the model scheme with such modifications as they deemed necessary in the light of local conditions. As a result of this, three schemes have been sanctioned one each at the I.A.R.I., Bombay and Madhya Pradesh. The proposed sub-centres for animal nutrition to be coordinated by the Animal Nutrition Section, I.V.R.I. Izatnagar, are at (1) Anand, Bombay State (already initiated) and (2) Bangalore. Another centre is proposed to be set up in the eastern region.

CHAPTER VI.—STATISTICAL RESEARCH

ADVISORY WORK

The Statistical Branch of the Council continued its advisory work relating to the design of agricultural and animal husbandry experiments and the interpretation of their results, examination of technical programmes and annual reports of the Council's schemes and the scrutiny of statistical papers received for publication in the Council's journals. A number of statistical enquiries received from the Food and Agricultural Organisation of the United Nations, Central Government, State Governments and other institutions were also dealt with.

TRAINING

Following are the results of examinations held at the end of the 1950-51 session :

Applicational Course

All the 11 candidates admitted, successfully completed the first term of the course, while nine of them including one from the technical staff of the Statistical Branch pursued and successfully completed the full course.

Certificate Course

Out of the 20 students admitted, 10 students passed the examination conducted in June, 1951. One member of the technical staff of the Branch also passed this examination.

Diploma Course

Four students passed the written examination and three candidates submitted their thesis, which were approved by the examiners for the award of the Diploma.

The fourth convocation for the award of diplomas, certificates and prizes to the successful students of the year was held on 19 December, 1951, and prizes and certificates were distributed by the Prime Minister of India. During the year under report certain changes were made in the organisation of the training courses, the details of which were given in the prospectus of the Training Courses, 1951. The principal change was the relegation of the former Certificate Course to the background as pre-requisite for admission to the Diploma Course and its replacement by the new one-year Applicational Course, higher in standard and more elaborate in scope than the old Applicational Course.

The number of students admitted in the new one-year Application Course during the year under report was 87. Out of the 11 students who passed the Certificate Course of last year, nine joined the Diploma Course. At present there are nine students in all deputed by the State Governments of Bihar, Orissa, Madras and Uttar Pradesh.

Students of the Application Course and the Diploma Course visited a number of Agricultural and Animal Husbandry Research Institutions.

All the students had about 15 days training in field work in March, 1952, in the villages under the Delhi Development Scheme where they acquainted themselves with the *patwari's* work in the collection of statistics of crop acreages and conducted crop-cutting experiments by the random sampling method on wheat and gram.

RESEARCH

Estimation

Crop-cutting Surveys for Estimation of Yields

With the implementation of the co-ordinated scheme of crop-cutting surveys on principal food crops, surveys were initiated in all Part 'A' States, Part 'B' States of Hyderabad, PEPSU, and Rajasthan, and Part 'C' States of Delhi, Ajmer, Coorg, Bhopal, and Vindhya Pradesh. For the States in which the surveys had been carried out, the survey estimates of production of wheat (1950-51) and rice (1951-52) was 5.6 million tons as against the corresponding official estimates of 5.1 million tons. The State Governments were asked to adopt the results obtained from the surveys in the official forecasts issued by them and this was given effect to by a number of States. In addition to food crops, surveys, on a pilot scale for estimating the yield of groundnut and ginger in Madras, and of jute in Assam, Bihar and Orissa, were carried out.

Statistical Assessment of 'Grow More Food' Campaign

Sample surveys for assessing the results of activities under G.M.F. campaign were extended to Orissa, Bihar, Assam and Madhya Bharat in addition to the States already covered last year, viz. Madras, Madhya Pradesh, and Bombay. The scope of these surveys was widened during 1951-52 by covering minor irrigation works, such as wells in Bihar, *dongs*, bunds and channels in Assam, and the reclamation of *kans*-infested land by tractors under the Central Tractor Organisation. Growing experience of these surveys showed that the random sampling technique was widely applicable in the field and able to provide highly useful results.

An all-India sample check of the irrigation works claimed to have been constructed in the various States since the beginning of L/N2ICAR

the campaign was instituted. In respect of certain wells selected at random, a spot enquiry was proposed to be carried out by actually visiting the villages and the survey numbers in which the selected wells are reported to be situated, and checking up of their actual functioning and the area of crops under irrigation.

The data collected from the spot check would provide the basis for an objective assessment as to how far the official estimates regarding the benefits from irrigational wells were really in agreement with the actual conditions prevailing.

Sample Survey for the Estimation of Acreage under Principal Crops in Orissa

A sample survey for the estimation of acreage under principal crops was launched in Orissa in 1950-51 under the technical guidance of the Indian Council of Agricultural Research. The plan followed was somewhat different from the one generally adopted in such surveys carried out earlier in this country. The present crop survey also included one district which was not cadastrally surveyed and hence did not possess detailed village maps or exact field measurement of survey numbers. The results of the survey demonstrated that the sampling plan adopted both for cadastrally surveyed and unsurveyed areas was capable of providing estimates of acreage under the major crop of rice with reasonable degree of accuracy for each district and with a high degree of accuracy for the State as a whole. The survey carried out in the unsurveyed district of Koraput was the first of its kind to be attempted in this country and proposals are now under consideration to extend the technique to other similar tracts in the Union.

Sample Survey for Estimating the Total Catch of Fish in the Malabar Coast

A brief reference to this survey was made in the last year's report. The field work of the survey was completed during April, 1952. A preliminary analysis of the data showed that the total catch of fish for the period of survey extending over 30 weeks, was estimated with a sampling error of about 5 per cent, thus demonstrating the feasibility of the sampling method adopted. Further study of the data is in progress.

Sample Survey for Improving Livestock Statistics

A reference was made in the last year's report, of an exploratory survey carried out in one district of U.P. for the improvement of livestock statistics. The primary object of the survey was to devise a rationalized programme of supervision over the quinquennial livestock census, which, while ensuring the accuracy of primary enumeration, would also provide independent estimates of livestock numbers under major categories. The survey was carried out in about 15 per cent of

the villages selected at random from each *tahsil*. Altogether about 200 villages were selected and a complete house to house enumeration was made of the livestock in each selected village with the help of an *ad hoc* agency. A preliminary analysis of data showed that a supervisory programme based on the principles of random sampling could be evolved to secure the above object. It was observed that by selecting about 600 villages in a State and checking, on the spot, a sub-sample of 20 households in each selected village, it would be possible to estimate from the check-data so collected the State-wise totals of major categories of livestock with a fairly high degree of precision, viz. a standard error of 2 per cent. The results of the survey further revealed that annual estimates of livestock totals for major categories could also be obtained during inter-censal period by sampling a comparatively small number of villages (of the order of 800) and making a complete enumeration of households in each village.

Sampling of Wool for Estimation of Fibre Length, Fibre Diameter and Medulation

To evolve a dependable method of sampling Indian wool for the study of its characteristics such as fibre length, fibre diameter and medulation, etc. an *ad hoc* committee was set up to consider the problem and make necessary recommendations. The committee at the first meeting, observed that the sampling of wool might be considered from two different aspects, viz. (i) sampling from the body of a sheep and (ii) sampling from a commercial bulk of wool. The committee recommended two separate experiments for evolving efficient methods of sampling for the two cases. While there was little difficulty in formulating all the details of the experiment for sampling from the body of a sheep, the case was different in regard to the other experiment. In the latter, the method of preparation of a representative sample of wool was specified, but a preliminary experiment was considered necessary to throw light on the best method of drawing fibres from the prepared sample. A preliminary experiment was undertaken at Poona accordingly. The *ad hoc* committee discussed the results of the experiment and completed all details of the experiment for evolving an efficient method of sampling from a commercial bulk of wool. These experiments are in progress now.

Cost of Milk Production

At the request of the Dairy Science Committee of the Council, the Statistical Branch, in consultation with other experts, drew up the outlines of a scheme for the study of the problem of cost of production of milk. The scheme was very comprehensive in nature. It was, however, felt subsequently that as there was a large number of unknown or imperfectly known factors contributing to the cost of production of milk in the prevalent conditions of production in this

country, it would be desirable, before taking up the scheme on such a wide scale, to conduct a preliminary enquiry to find out the relative importance of different items of cost of production and to study how far these items could be ascertained objectively. The preliminary enquiry was accordingly planned and it was proposed to conduct it in the municipal area of Delhi and the villages under the Delhi Development Scheme representing respectively the urban and the rural conditions of milk production. The producer units were categorized into stables of different sizes in the urban area and the cultivator units and the non-cultivator units in the rural area. A preassigned number of producer units were selected within each type for the enquiry. This enquiry is expected to help in laying down the procedure in the collection of reliable information on various items of cost of production of milk.

Face Colour Study in Bikaneri Sheep

A study was undertaken to find out how far a prejudice among the indigenous breeders against breeding white-faced Bikaneri sheep, because they were supposed to be constitutionally weak, as compared to sheep of other face colours, viz. tan and black, was justified. The materials for this study was collected from the data relating to the Council's Sheep Breeding Scheme at Hissar from 1936-37 to 1946-47. A comprehensive report was prepared on the subject giving the results of the statistical analysis of these data. The results revealed that the white-faced Bikaneri sheep were in no way found to fare worse than the other Bikaneri sheep, viz. tan and black.

Nutritive Value of Vanaspati (Vegetable Oils)

A scheme on this subject was financed by the Indian Council of Agricultural Research in 1944. The scheme was worked out at the Animal Nutrition Section of the Indian Veterinary Research Institute, and completed recently. A very large volume of data was collected on various aspects of the problem of examining the nutritive value of different *vanaspatis* available in the country. At the instance of the Animal Nutrition Committee of the Council, a detailed statistical study of these data was conducted and a report prepared giving the results of these studies.

Statistical Study of the Data Collected in the Council's Animal Breeding Schemes

A research scheme on sheep breeding was in operation at Hissar for 10 years from 1937 to 1946 under the Council. The objects of the scheme were (i) systematic improvement of sheep of the Bikaneri breed, (ii) investigation of economic factors of importance to sheep breeding and (iii) providing pedigree Bikaneri sheep for further experimental breeding work in other States. A similar scheme on sheep breeding was also financed by the Council in Mysore. This scheme

started in November, 1940 and continued for five years. The main object of the scheme was to find out the possibilities of improving the quality and quantity of wool of the indigenous breeds of sheep under controlled conditions of breeding, feeding, care and management. The accumulated data relating to these schemes were recently examined, and it was felt that their critical statistical analysis might lead to results of far reaching importance to the sheep breeders in general. At the instance of the Statistical Adviser of the Council, a scheme for the statistical study of the data collected in the two schemes has now been undertaken and the statistical study has commenced.

Ad hoc Committee for G.M.F. Assessment Results

The fourth meeting of the *ad hoc* Committee for G.M.F. Assessment Results was held at New Delhi in December, 1951, with a view to review the progress made in the G.M.F. Assessment Schemes.

Improvement of Agricultural Statistics

The Integrated Scheme for the improvement of Agricultural Statistics prepared by the Statistical Adviser, Indian Council of Agricultural Research, was under the active consideration of the Government of India, during the year.

Improvement of Livestock and Fishery Statistics

A scheme for the improvement of Livestock and Fishery Statistics was prepared and submitted to the Government of India for sanction.

Theoretical Research

A number of technical papers were prepared by the staff of the Council during 1951-52. Some of the important papers are given below :

- (1) Further contributions to the theory of Probability Distribution of points in a line—Part III by Dr Krishna Iyer.
- (2) Calculation of factorial moments and cumulants of some distributions arising from Markoff chains by Dr Krishna Iyer.
- (3) The problem of distances in sampling by Dr Krishna Iyer and Daroga Singh.
- (4) The use of difference equations in solving distribution problems in statistics by Dr Krishna Iyer.
- (5) Runs in a sequence of observations by Dr Krishna Iyer and A.S.P. Rao.

CHAPTER VII—GENERAL

LIBRARY

Classification and Cataloguing

All new additions of books and publications were accessioned, classified and catalogued. A card catalogue comprising author and subject entries arranged in dictionary form has been maintained and continuously brought up-to-date. The Dewey Decimal Classification Scheme was used in the library. Besides the card catalogue there was a printed catalogue for publications upto 1934 with 12 printed supplements for additions upto December, 1941. This was further supplemented by a typed catalogue containing additions from 1942 to 1946. Lists of latest additions to the library were circulated to those interested at regular intervals.

The Librarian secured a scholarship under the Colombo Plan for a short period of training in Australia in Library Management.

Library Statistics

During the year 329 new books were added and 150 periodicals subscribed for addition to 400 obtained on exchange. One hundred and fifty publications were issued on loan and 6450 consulted for reference purposes.

APPENDIX I

List of meetings of the Indian Council of Agricultural Research held during the year 1951-52

1. A meeting of the local members of the Board of Extension, April, 1951 .
2. Eleven meetings of the Local Sub-Committee of the Standing Committee
3. Joint meeting of the Governing Body and the Advisory Board, May, 1951
4. The meetings of the Board of Research, June and October, 1951
5. Three joint meetings of the Boards of Research and Extension, July and November, 1951 and March, 1952
6. Wheat and Rice Research Workers' Conference, July, 1951
7. Two meetings of the Wheat Rust Control Committee
8. Two Seminars of Extension Officers, September, 1951 and March, 1952
9. Nineteen meetings of the various Scientific and Commodity Committees, October-November, 1951
10. Conference of the State Ministers of Agriculture, Vice-Chancellors and Deans of the Faculty of Agriculture in the Indian Universities to consider the question of re-organisation of Agricultural (including Veterinary and Dairy) Education in the country, November, 1951
11. Conference of the Directors of Animal Husbandry and/or Veterinary Services of the States, November, 1951
12. Meeting of the Advisory Board, November, 1951
13. Meeting of the sub-committee for laying down a syllabus for the refresher courses in agriculture for young farmers
14. Two meetings of the Standing Finance Committee, August and December, 1951
15. Conference of the State Statisticians, December, 1951
16. Meeting of the Standing Committee, December, 1951
17. Meeting of the Governing Body, December, 1951
18. Annual General Meeting, December, 1951.
19. Conference of the State Directors of Agriculture, March, 1952

APPENDIX II

List of schemes sanctioned by the Governing Body at its meeting held on 19-12-51

AGRICULTURE SCHEMES

- | | | | |
|---|-----|-----|------------------------------------|
| 1. Improvement of pastures | ... | ... | I.A.R.I., New Delhi |
| 2. Improvement of pastures | ... | ... | Bombay |
| 3. Improvement of pastures | ... | ... | Madhya Pradesh |
| 4. Usar Land Paddy Scheme | ... | ... | Uttar Pradesh |
| 5. Survey and collection of paddy from the
Jeypore tract of Orissa | ... | ... | C.R.R.I., Cuttack |
| 6. Paddy breeding | ... | ... | Madhya Bharat |
| 7. Maize breeding | ... | ... | Almora (Vivekananda
Laboratory) |
| 8. Medicinal Plants Scheme | ... | ... | F.R.I., Dehra Dun |
| 9. Nitrogen fixation | ... | ... | Bombay |
| 10. Nitrogen fixation | ... | ... | Punjab |
| 11. Rapid soil tests | ... | ... | I.A.R.I., New Delhi |
| 12. Wheat physiology | ... | ... | Delhi University |
| 13. Termite research | ... | ... | I.A.R.I., New Delhi |
| 14. Termite research | ... | ... | F.R.I., Dehra Dun |
| 15. Termite research | ... | ... | Anand Agricultural
Institute |
| 16. Pre-soaking seeds in nutrient salts | ... | ... | Madras |
| 17. Preparation of a bulletin on cultural ex-
periments on rice | ... | ... | C.R.R.I., Cuttack |
| 18. Multiplication of US 13 maize seed | ... | ... | Almora |
| 19. Cash Crops Enquiry Scheme | ... | ... | Headquarter |
| 20. Improvement of vegetables | ... | ... | Orissa |
| 21. Research on date palm | ... | ... | Punjab |

ANIMAL HUSBANDRY SCHEMES

- | | | | |
|--|-----|-----|---------------|
| 1. Evolving suitable draught capacity
measures for bullocks | ... | ... | I.V.R.I. |
| 2. Selective breeding and grading up of
indigenous cattle | ... | ... | Orissa |
| 3. Metabolic effects of hormones in rela-
tion to induced lactation | ... | ... | Uttar Pradesh |
| 4. Definition of breed characteristics of
Amrit Mahal and Hallikar cattle | ... | ... | Mysore |
| 5. Training in sheep and wool production | ... | ... | Punjab |
| 6. Development of mutton breeds of sheep | ... | ... | Bombay |
| 7. Development of mutton breeds of sheep | ... | ... | Madras |
| 8. Development of mutton breeds of sheep | ... | ... | Mysore |

APPENDIX II—contd.

- | | | | |
|--|-----|-----|--------------------|
| 9. Duck breeding | ... | ... | Travancore-Cochin |
| 10. Defertilisation of eggs and improved packing | ... | ... | Travancore-Cochin |
| 11. Establishment of regional sub-stations for animal nutrition work | ... | ... | I.D.R.I. |
| 12. Investigation on mastitis | ... | ... | I.V.R.I. |
| 13. Investigation on mastitis | ... | ... | Punjab |
| 14. Disease Investigation Officer | ... | ... | Madhya Bharat |
| 15. Disease Investigation Officer | ... | ... | PEPSU |
| 16. Disease Investigation Officer | ... | ... | Saurashtra & Kutch |
| 17. Methods of <i>ghee</i> analysis | ... | ... | Hyderabad |
| 18. Awards of fellowship in dairying | ... | ... | I.C.A.R. |
| 19. Training course in livestock marketing | ... | ... | I.C.A.R. |

MISCELLANEOUS SCHEMES

1. Publication of a quarterly '*Rice News Teller*'
2. Improvement of the get up and timely publications of the scientific journals of the Council
3. Application from the Entomological Society of India for a grant for publishing the report on the progress and control of the Desert Locust Cycle
4. Scheme for setting up of an Indian Council of Agricultural Education
5. Contribution to the Commonwealth Agricultural Bureaux
6. Co-ordinated Scheme of Extension Work
7. Appointment of Extension Service Staff in Delhi State
8. Scheme to invite a Statistician of repute from the F.A.O. to assist in teaching and research programme of the Statistical Branch, I.C.A.R.

APPENDIX III

List of schemes terminated during the year 1951-52

AGRICULTURE SCHEMES

- | | | | |
|---|-----|-----|----------------------------|
| 1. Rice breeding | ... | ... | Bombay |
| 2. Rice breeding | ... | ... | Kashmir |
| 3. Pulses research | ... | ... | Mysore |
| 4. Small millets | ... | ... | Mysore |
| 5. Insect pests of stored cereal grains | ... | ... | Punjab |
| 6. Ginger cultivation | ... | ... | Madras |
| 7. Control of erosion | ... | ... | Viswabharati (West Bengal) |
| 8. Small millets | ... | ... | Uttar Pradesh |
| 9. Crop seed | ... | ... | Delhi University |
| 10. Banana research | ... | ... | Calcutta University |
| 11. Control of orange diseases in Wynad | ... | ... | Madras |
| 12. Cytogenetics of mango and banana | ... | ... | Poona |
| 13. Training in fruit preservation | ... | ... | Punjab |
| 14. Fruit Research Scheme | ... | ... | Bihar |
| 15. Fruit Research Scheme | ... | ... | Madras |
| 16. Mango necrosis | ... | ... | Lucknow University |

ANIMAL HUSBANDRY SCHEMES

- | | | | |
|---|-----|-----|--------------------------------------|
| 1. Sheep breeding | ... | ... | Madras |
| 2. Sheep breeding | ... | ... | Bombay |
| 3. Sheep breeding | ... | ... | Punjab |
| 4. Sheep breeding | ... | ... | Kashmir |
| 5. Helminthiasis | ... | ... | Madras |
| 6. Tuberculin testing | ... | ... | Madras |
| 7. Indigenous drugs used in veterinary medicines from old Sanskrit manuscript | ... | ... | Madras |
| 8. Nutritive value of <i>vanaspati</i> | ... | ... | Indian Veterinary Research Institute |
| 9. Standardising certain methods for the analysis of <i>ghee</i> | ... | ... | Indian Dairy Research Institute |
| 10. Quality improvement in milk and milk products | ... | ... | Uttar Pradesh |
| 11. Rapid determination of fats, etc. in milk | ... | ... | Punjab |
| 12. Bacteriological quality of market milk | ... | ... | West Bengal |
| 13. Rural pisciculture | ... | ... | Madras |
| 14. Fishery research scholarship | ... | ... | Travancore University |
| 15. Indigenous drugs of India with special reference to their toxicology | ... | ... | Madras |
| 16. Indigenous drugs used in veterinary practices in northern India | ... | ... | I.C.A.R. |
| 17. Improvement of livestock statistics | ... | ... | I.C.A.R. |
| 18. Collection of marine fishery statistics | ... | ... | I.C.A.R. |

APPENDIX IV

*List of members of the Indian Council of Agricultural Research Society
as reconstituted on 31 March, 1952*

1. The Hon'ble Shri K. M. Munshi, Minister for Agriculture, Government of India, New Delhi. (President).
2. Sardar Datar Singh, Vice-President, Indian Council of Agricultural Research, New Delhi
3. The Hon'ble Shri M. Thirumala Rao, Deputy Minister for Agriculture, Government of India, New Delhi
4. The Hon'ble Shri Ome Kumar Das, Minister-in-charge of Agriculture, Assam, Shillong
5. The Hon'ble Dr Syed Mahmud, Minister-in-charge of Agriculture, Bihar, Patna
6. The Hon'ble Shri M. P. Patil, Minister-in-charge of Agriculture, Bombay
7. The Hon'ble Shri D. K. Mehta, Minister-in-charge of Agriculture, Madhya Pradesh, Nagpur
8. The Hon'ble Shri A. B. Shetty, Minister-in-charge of Agriculture, Madras
9. The Hon'ble Shri K. P. Nanda, Minister-in-charge of Agriculture, Orissa, Cuttack
10. The Hon'ble Shri Charan Singh, Minister-in-charge of Agriculture, Uttar Pradesh, Lucknow
11. The Hon'ble Shri P. C. Sen, Minister-in-charge of Agriculture, West Bengal, Calcutta
12. The Hon'ble Shri Vinayak Rao Koratkar, Minister for Agriculture, Hyderabad, Hyderabad-Deccan
13. The Hon'ble Mirza Mohd. Afzal Beg, Minister for Agriculture, Jammu and Kashmir, Srinagar
14. The Hon'ble Dr Prem Singh Rathore, Minister for Agriculture, Madhya Bharat, Gwalior
15. The Hon'ble Shri T. Mariappa, Minister for Agriculture, Mysore, Bangalore
16. The Hon'ble Giani Zail Singh, Minister for Agriculture, PEPSU, Patiala
17. The Hon'ble Shri Mohan Lal Sukhadia, Minister for Agriculture, Rajasthan, Jaipur
18. The Hon'ble Shri D. T. Dave, Minister for Agriculture, Saurashtra, Rajkot
19. The Hon'ble Shri T. K. Narayana Pillai, Minister for Agriculture, Travancore-Cochin, Trivandrum
20. Shri K. L. Mehta, I.C.S., Chief Commissioner, Ajmer
21. Shri B. Viswanathan, I.C.S., Chief Commissioner, Bhopal
22. Shri Sri Chand Chhabara, Chief Commissioner, Bilaspur (Simla Hills)
23. Lt. Col. D. S. Bedi, Chief Commissioner, Coorg, Mercara
24. Shri Shankar Prasad, I.C.S., Chief Commissioner, Delhi

APPENDIX IV—*contd.*

25. Shri Bhagwan Sahay, I.C.S., Chief Commissioner, Himachal Pradesh, Himachal Dham, Simla
26. Shri S. A. Ghatge, Chief Commissioner, Kutch, Bhuj
27. Shri E. P. Moon, Chief Commissioner, Manipur, Imphal
28. Major A. B. Chatterjee, Chief Commissioner, Tripura, Agartala
29. Shri V. K. Pillai, Chief Commissioner, Vindhya Pradesh, Rewa
30. Shri L. K. Handique, Director of Agriculture, Assam, Shillong
31. Dr J. S. Patel, Director of Agriculture, Bihar, Patna
32. Dr B. N. Uppal, Director of Agriculture, Bombay State, Poona
33. Dr R. J. Kalamkar, Director of Agriculture, Madhya Pradesh, Nagpur
34. Shri M. S. Sivaraman, I.C.S., Director of Agriculture, Madras, Chepauk, Madras.
35. Shri S. N. Pujari, Director of Agriculture, Orissa, Cuttack
36. Shri B. S. Sawhney, Director of Agriculture, Punjab, Simla
37. Dr S. B. Singh, Director of Agriculture, Uttar Pradesh, Lucknow
38. Shri H. K. Nandi, Director of Agriculture, West Bengal
39. Shri P. D. Nair, Director of Agriculture, Hyderabad, Hyderabad-Deccan
40. Shri G. M. Butt, Director of Agriculture, Jammu and Kashmir, Jammu Tawai, Srinagar
41. Shri N. M. Deshmukh, Director of Agriculture, Madhya Bharat, Gwalior
42. Shri M. K. Appajappa, Director of Agriculture, Mysore, Bangalore
43. Dr Arjan Singh, Director of Agriculture, PEPSU, Nabha
44. Shri S. V. Desai, Director of Agriculture, Rajasthan, Bharatpur
45. Shri M. Sankara Menon, Director of Agriculture, Travancore-Cochin, Trivandrum
46. Shri J. C. Ramchandani, Director of Agriculture, Saurashtra, Rajkot
47. Shri G. K. Mehra, Director of Veterinary Services, Assam, Gauhati
48. Shri M. I. Mabk, Director of Veterinary Services, Bihar, Patna
49. Shri L. Sahai, Director of Animal Husbandry and Veterinary Services, Bombay State, Poona
50. Shri M. Y. Mangrulkar, Director of Veterinary Services, Madhya Pradesh, Nagpur
51. Shri V. R. Rajagopalan, Director of Animal Husbandry, Chepauk, Madras
52. Shri G. B. Singh, Director of Animal Husbandry and Veterinary Services, Orissa, Cuttack
53. Major A. C. Aggarwala, Director of Veterinary Services, Punjab, Simla

APPENDIX IV—*concl'd.*

54. Dr R. L. Kaura, Director of Animal Husbandry, Uttar Pradesh, Lucknow
55. Shri P. C. Bannerji, Assistant Director of Veterinary Services, West Bengal, Calcutta
56. Shri S. A. Jabbar, Director, Civil Veterinary Department, Hyderabad, Hyderabad-Deccan
57. Shri V. L. Wazir, Director, Civil Veterinary Department, Jammu and Kashmir, Srinagar
58. Shri H. K. Mehra, Director, Veterinary and Animal Husbandry Services, Madhya Bharat, Gwalior
59. Dr P. M. Narayanaswami Naidu, Director, Department of Animal Husbandry, Mysore, Bangalore
60. Sardar Pritam Singh Brar, Superintendent, Veterinary Department, PEPSU, Nabha
61. Dr G. S. Rathore, Deputy Director of Veterinary Services, Rajasthan, Jaipur
62. Shri C. N. Dave, Livestock Officer, Saurashtra, Rajkot
63. Shri V. K. Madhava Menon, Director of Veterinary Services, Travancore-Cochin, Trivandrum
64. Shri Vishnu Sahay, I.C.S., Secretary, Ministry of Food and Agriculture, New Delhi
65. Shri B. Shiva Rao, Member, Parliament, 4, Hardinge Avenue, New Delhi
66. Shri Devi Dutt Pant, Member, Parliament, Almora, U.P.
67. Shri U. Srinivasa Mullayya, Member, Parliament, 17, Ferozeshah Road, New Delhi
68. Shri G. A. Thimappa Gowda, Member, Parliament, Hassan, Mysore State
69. Thakur Bhawani Pratap Singh, Member, Parliament, P.O. Konakhan, District Raipur, Madhya Pradesh
70. Shri J. McIntyre, c/o Imperial Chemical Industries (India) Ltd., Calcutta (Representative of the business communities in India)
71. Shri Ratilal M. Gandhi, c/o Messrs Ratilal and Co., Clurud Buder Road, Bombay-9 (Representative of the business communities in India)
72. Shri R. L. Sethi, Agricultural Commissioner with the Government of India
73. Shri P. N. Nanda, Animal Husbandry Commissioner with the Government of India
74. Dr T. G. Shirname, Agricultural Marketing Adviser to the Government of India, Directorate of Marketing and Inspection, New Delhi
75. Dr B. P. Pal, Director, Indian Agricultural Research Institute, New Delhi and Vice-Chairman, Board of Research
76. Dr S Datta, Director, Indian Veterinary Research Institute, Izatnagar, U.P.
77. Shri M. S Thacker, Director, Indian Institute of Science, Bangalore 3

APPENDIX IV—*contd.*

78. Dr S. Ramanujam, Director, Central Rice Research Institute, Cuttack
79. Dr Pushkarnath, Director, Central Potato Research Institute, Patna
80. Shri C. R. Ranganathan, I.F.S., President, Forest Research Institute, P.O. New Forest, Dehra Dun
81. Dr M. D. Patel, Director, Institute of Agriculture, Anand
82. Dr K. C. Sen, Director, Indian Dairy Research Institute, Bangalore
83. Shri G. R. Valunjkar, Bone Meal Adviser, Ministry of Food and Agriculture, New Delhi (Representative of the Vana Premi Sangh)
84. Shri J. Bannerjee, Deputy I.G.F., Ministry of Food and Agriculture, New Delhi (Representative of the Central Board of Forestry)
85. Dr S. S. Bhatnagar, Director, Council of Scientific and Industrial Research, New Delhi
86. Col. B. M. Vencoba Rao, Secretary (Development) to the Chief Commissioner, Bhopal (Representative of the Central Malway Committee)
87. Shri M. D. Chaturvedi, I.F.S., Inspector-General of Forests, Ministry of Agriculture, New Delhi
88. Captain Dalipman Singh, Advocate, Chairman, District Co-operative Bank Ltd., Fatehpur
89. Dr C. G. Pandit, Secretary, Indian Council of Medical Research, New Delhi
90. Shrimati Lilawati Munshi, President, All India Women's Food Council, Jaisalmer House, New Delhi
91. Shri Kunji Lal Dube, Vice-Chancellor, Nagpur University, Nagpur
92. Nawab Ali Yawar Jung, Vice-Chancellor, Osmania University, Hyderabad-Dn
93. Dr B. L. Manju Nath, Vice-Chancellor, Mysore University, Bangalore
94. Dr V. S. Krishna, Vice-Chancellor, Andhra University, Waltair
95. Shri W. Wilson Mayne, c/o Messrs Kanan Devan Hills Produce Co. Ltd., Munnar, P.O. High Range, Travancore (Joint representative of the Indian Tea Association and*United Planters' Association of Southern India)
96. Shri S. N. Ramanna, Advocate and Coffee Planter, Chikamagalore, Mysore
97. Shri K. Srinivasan, Messrs A. V. Thomas & Co., Alleppey, Travancore-Cochin
98. Shri Chimanlal B. Parikh (Representative, Indian Central Cotton Committee, Bombay).
99. Shri B. K. Das, M.P. (Representative, Indian Central Jute Committee)
100. Shri K. P. Pande (Representative, Indian Lac Cess Committee), Jubbulpore
101. Shri M. Nageswara (Representative, Indian Central Tobacco Committee), Guntur

APPENDIX IV—*contd.*

102. Shri K. P. Madhavan Nair (Representative, Indian Central Coconut Committee), Ernakulam Mills, Ernakulam
103. Shri Deoji Rattansey (Representative, Indian Central Oilseeds Committee), Musjid Bunder Road, Bombay
104. Shri V. R. Krishna, Ezhuthassan (Representative, Indian Central Arecanut Committee), Avanissery, Ollur, Trichur
105. Shri R. G. Saraiya, Vice-President, Indian Central Cotton Committee, Navsari Chambers, Outram Road, Bombay
106. Shri I. G. Kennedy, Vice-President, Indian Central Jute Committee, c/o Messrs Jardine Hinderson Ltd., Clive Road, Calcutta
107. Shri Dip Narain Suha, M.L.A., Vice-President, Indian Central Sugar-cane Committee, c/o Co-operative Federation, Patna
108. Shri K. P. Madhavan Nair, Vice-President, Indian Central Coconut Committee, Ernakulam Mills Buildings, Ernakulam
109. Shri C. Subramanian, Member, Parliament, Vice-President, Indian Central Tobacco Committee, 11, Ferozeabad Road, New Delhi
110. Prof. N. G. Ranga, Member, Parliament, 10, Valliammal Road, Vepery, Madras-7, Vice-President, Indian Central Oilseed Committee, New Delhi
111. Shri U. Ramakrishna Mallayya, Vice-President, Indian Central Arecanut Committee, Post Box No. 23, Bunder Mangalor, Distt. South Kanara
112. Vice-President, Indian Lac Cess Committee, Ranchi (Cantt.)
113. Dr S. R. Sen, Economic and Statistical Adviser, Directorate of Economics and Statistics, Ministry of Food and Agriculture, Government of India, New Delhi
114. Dr V. G. Panse, Statistical Adviser, Indian Council of Agricultural Research, New Delhi
115. Dr B. N. Chopra, Deputy Fisheries Development Adviser to the Government of India, Ministry of Food and Agriculture, New Delhi (Representative, Fisheries Research Stations)
116. Shri M. S. Bhatnagar, Financial Adviser, I.C.A.R. (Joint Secretary, Ministry of Finance), New Delhi
117. Dr Ram Subhag Singh, Member, Parliament, 6, Ferozeshah Road, New Delhi (Representative, Rural Interests)
118. Shri Babu Sahib Deshpande, Illgapally, Bidar, Hyderabad State (Representative, Rural Interests)
119. Shri S. S. Salemath, West View, 6, Todiwala Road, Poona 1. U.B. Hill, Dharwar, Bombay State (Representative, Rural Interests)
120. The Secretary, Indian Council of Agricultural Research, New Delhi
121. Shri Tulsidas Kilachand, c/o Kilachand Devchand and Co., 45/47 Appollo Street, Bombay
122. Thakur Bhawani Singh of Pokaran, Pokaran House, Jodhpur
123. Shri Thakurdas Bhargava, Member, Parliament, Hissar
124. Shri T. Vijayaraghavacharaya, Rivertyde, Adyar, Madras

APPENDIX IV—*concl'd.*

125. Shri M. P. Gandhi, c/o Gandhi & Co., Jan Mansion, Sir Pherozshah Mehta Road, Fort, Bombay 1
126. The Director of Remounts, Veterinary and Farms, Army Headquarters, Quarter Master General's Branch, Simla
127. Shrimati Mira Behn, Ashram Pashulok, Rishi Kesh, U.P.
128. Shri Govind Das, Member, Parliament, 2, Canning Lane, New Delhi
129. Shri D. H. Duyf, Director & General Manager, Gwalior Sugar Co. Ltd., Dabra, Gwalior Distt. (Madhya Bharat)
130. Shrimati Lilawati Munshi, President, Agricultural Horticultural Society, Ministry of Food & Agriculture, Jaisalmer House, New Delhi
131. Shri K. R. Damle, I.C.S., Joint Secretary, Ministry of Food and Agriculture, Govt. of India, New Delhi (Vice-Chairman, Board of Extension)
132. Mrs. Marie Buck, Welfare Officer, Simpson's Medical Centre, Simpson and Co., 1, Cooum River Road, Napier Park, Chinladripet, Madras 2
133. Shri C. V. Narsimhan, I.C.S., Joint Secretary, Ministry of Food and Agriculture, New Delhi
134. Shri P. A. Gopalakrishnan, I.C.S., Joint Secretary, Ministry of Food and Agriculture, New Delhi
135. Shri Manilal M. Nanavati, President, Society of Agricultural Economics, Bombay
136. Shri S. C. Roy, Agricultural Extension Commissioner, I.C.A.R., New Delhi
137. Dr B. Viswanath, Adviser on Agricultural Programmes, Planning Commission, New Delhi
138. Shri Harjas Rai, Director of Animal Husbandry, Ajmer
139. Dr A. T. Sen, Land Development Commissioner, Delhi

APPENDIX V

List of members of the Governing Body

1. The Hon'ble Shri K. M. Munshi, Minister for Food and Agriculture, Government of India, New Delhi. (President)
2. Sardar Datar Singh, Vice-President, Indian Council of Agricultural Research, New Delhi
3. The Hon'ble Shri M. Thirumala Rao, Deputy Minister for Food and Agriculture, Government of India, New Delhi
4. The Hon'ble Shri Ome Kumar Das, Minister for Food and Agriculture, Government of Assam, Shillong
5. The Hon'ble Dr Syed Mahmud, Minister for Agriculture, Government of Bihar, Patna
6. The Hon'ble Shri M. P. Patil, Minister for Agriculture and Forests, Government of Bombay, Bombay
7. The Hon'ble Shri D. K. Mehta, Minister-in-charge of Agriculture, Animal Husbandry and Fisheries, Government of Madhya Pradesh, Civil Lines, Nagpur
8. The Hon'ble Shri A. B. Shetty, Minister for Agriculture, Government of Madras, Fort St. George, Madras
9. The Hon'ble Shri K. P. Nanda, Minister-in-charge of Agriculture, Government of Orissa, Cuttack
10. The Hon'ble Shri Charan Singh, Minister-in-charge of Agriculture, Government of Uttar Pradesh, Lucknow
11. The Hon'ble Shri Prafulla Chandra Sen, Minister-in-charge of Agriculture, West Bengal, Calcutta
12. The Hon'ble Shri Vinayak Rao Koratkar, Minister-in-charge of Agriculture, Government of Hyderabad, Hyderabad
13. The Hon'ble Mirza Mohd. Afzal Beg, Minister-in-charge of Agriculture, Government of Jammu and Kashmir, Srinagar
14. The Hon'ble Shri Prem Singh Rathore, Minister for Development, Government of Madhya Bharat, Gwalior/Indore
15. The Hon'ble Shri T. Mariappa, Minister-in-charge of Agriculture, Government of Mysore, Old Public Offices, Bangalore
16. The Hon'ble Gyani Zail Singh, Minister-in-charge of Agriculture, Government of Patiala and East Punjab States Union, Patiala
17. The Hon'ble Shri Mohanlal Sukhadia, Minister-in-charge of Agriculture, Government of Rajasthan, Jaipur
18. The Hon'ble Shri D. T. Dave, Minister for Agriculture, Government of Saurashtra, Rajkot
19. The Hon'ble Shri T. K. Narayana Pillai, Minister-in-charge of Agriculture, Government of Travancore-Cochin, Trivandrum
20. Shri K. L. Mehta, I.C.S., Chief Commissioner, Ajmer
21. Shri V. Vishwanathan, I.C.S., Chief Commissioner, Bhopal
22. Shri Shri Chand Chhabra, Chief Commissioner, Bilaspur State, Simla Hills
23. Lt. Col. Daya Singh Bedi, Chief Commissioner, Coorg, Mercara
24. Shri Shankar Prasad, I.C.S., Chief Commissioner, Delhi
25. Shri Bhagwan Sahay, I.C.S., Chief Commissioner, Himachal Pradesh, Himachal Secretariat, Simla-4
26. Shri S. A. Ghatge, Chief Commissioner, Kutch, Umed Bhawan, Bhuj

APPENDIX V—*contd.*

27. Shri E. P. Moon, Chief Commissioner, Manipur, Imphal
28. Major A. B. Chatterjee, Chief Commissioner, Tripura, Agartala
29. Shri V. K. B. Pillai, I.C.S., Chief Commissioner, Vindhya Pradesh, Rajniwas, Rewa
30. Shri Vishnu Sahay, I.C.S., Secretary, Ministry of Food and Agriculture, Government of India, New Delhi
31. Shri B. Shiva Rao, Member, Parliament, 4, Hardinge Avenue, New Delhi
32. Shri Devi Datt Pant, Member, Parliament, Angel Abode, Almora, U.P.
33. Shri R. L. Sethi, Agricultural Commissioner with the Government of India, New Delhi
34. The Animal Husbandry Commissioner with the Government of India, New Delhi
35. Shri R. G. Saraiya, Vice-President, Indian Central Cotton Committee, Navsari Chambers, Outram Road, Fort, Bombay 1
36. Dr B. P. Pal, Director, Indian Agricultural Research Institute and Vice-Chairman, Board of Research, New Delhi
37. Shri K. R. Damle, I.C.S., Joint Secretary, Ministry of Food and Agriculture and Vice-Chairman, Board of Extension, New Delhi
38. Shri M. S. Bhatnagar, Financial Adviser, Indian Council of Agricultural Research (Joint Secretary, Ministry of Finance, Government of India), New Delhi
39. Dr S. R. Sen, Economic and Statistical Adviser, Ministry of Food and Agriculture, Government of India, New Delhi
40. Shri J. V. A. Nehemiah, Secretary, Indian Council of Agricultural Research, New Delhi
41. Shri Tulsidas Kilachand, c/o Kilachand Devchand & Company, 45-47, Appollo Street, Bombay
42. Thakur Bhawani Singh of Pokaran, Pokaran House, Jodhpur
43. Shri Thakur Das Bhargava, Member, Parliament (Advocate, Hissar, Punjab), 31, Canning Lane, New Delhi
44. Dr B. N. Uppal, Director of Agriculture, Bombay State, Poona
45. Shri T. Vijaya Raghavacharya, Rivertyde, Adyar, Madras
46. Shri M. P. Gandhi, c/o Gandhi & Co., Jan Mansion, Sir Pherozshah Mehta Road, Fort, Bombay

APPENDIX VI

List of members of the Advisory Board

1. Sardar Datar Singh, Vice-President, Indian Council of Agricultural Research, New Delhi. (Chairman)
2. The Agricultural Commissioner with the Government of India, New Delhi
3. Shri P. N. Nanda, Animal Husbandry Commissioner with the Government of India, New Delhi
4. Dr T. G. Shirname, Agricultural Marketing Adviser to the Government of India, Directorate of Marketing and Inspection, Ministry of Food and Agriculture, New Delhi
5. Dr S. R. Sen, Economic and Statistical Adviser, Directorate of Economic and Statistics, Ministry of Food and Agriculture, Government of India, New Delhi
6. Dr V. G. Panse, Statistical Adviser, Indian Council of Agricultural Research, New Delhi
7. Dr B. P. Pal, Director, Indian Agricultural Research Institute, New Delhi
8. Dr S. Datta, Director, Indian Veterinary Research Institute, Mukteswar, Kumaon, Izatnagar
9. Shri M. S. Thacker, Director, Indian Institute of Science, Bangalore
10. Dr K. C. Sen, Director, Indian Dairy Research Institute, Bangalore
11. Dr S. Ramanujam, Director, Central Rice Research Institute, Cuttack
12. Dr Pushkar Nath, Director, Central Potato Research Institute, Patna
13. Shri L. K. Handique, Director of Agriculture, Assam, Shillong
14. Dr J. S. Patel, Director of Agriculture, Bihar, Patna
15. Dr B. N. Uppal, Director of Agriculture, Bombay State, Poona
16. Dr R. J. Kalamkar, Director of Agriculture, Madhya Pradesh, Nagpur
17. Shri M. S. Sivaraman, I.C.S., Director of Agriculture, Madras
18. Shri S. N. Pujari, Director of Agriculture, Orissa, Cuttack
19. Shri B. S. Sawhney, Director of Agriculture, Punjab, Simla
20. Dr Sant Bahadur Singh, Director of Agriculture, Uttar Pradesh, Lucknow
21. Dr H. K. Nandi, Director of Agriculture, West Bengal, Calcutta
22. Shri P. D. Nair, Director of Agriculture, Hyderabad, Hyderabad-Dn
23. Shri G. M. Butt, Director of Agriculture, Jammu and Kashmir, Srinagar
24. Shri N. M. Deshmukh, Director of Agriculture, Madhya Bharat, Gwalior
25. Shri M. K. Appajappa, Director of Agriculture, Mysore, Bangalore
26. Dr Arjan Singh, Director of Agriculture, Patiala and East Punjab States Union, Patiala
27. Dr S. V. Desai, Director of Agriculture, Rajasthan, Jaipur
28. Dr J. C. Ramchandani, Director of Agriculture, Saurashtra, Rajkot
29. Shri M. Sankara Menon, Director of Agriculture, Travancore-Cochin, Trivandrum
30. Shri G. K. Mehta, Director of Veterinary Services, Assam, Gauhati
31. Shri M. I. Malik, Director of Veterinary Services, Bihar, Patna

APPENDIX VI—*contd.*

32. Shri Lakshmi Sahai, Director of Veterinary Services and Animal Husbandry, Bombay State, Poona
33. Shri M. Y. Mangrulkar, Director of Veterinary Services, Animal Husbandry and Fisheries, Madhya Pradesh, Nagpur
34. Shri V. R. Rajagopalan, Director of Animal Husbandry, Madras, Chepauk, Madras
35. Shri Gurbachan Singh, Director of Animal Husbandry and Veterinary Services, Orissa, Cuttack
36. Major A. C. Aggarwala, Director of Veterinary Services and Warden of Fisheries, Punjab, Simla
37. Dr R. L. Kaura, Director of Animal Husbandry, Uttar Pradesh, Lucknow
38. Shri P. C. Bannerjee, Assistant Director of Veterinary Services, West Bengal, Calcutta
39. Shri S. A. Jabbar, Director of Civil Veterinary Department, Hyderabad, Hyderabad-Dn.
40. Shri V. L. Vazir, Director, Civil Veterinary Department, Jammu and Kashmir, Srinagar
41. Shri H. K. Mehra, Director of Veterinary Services and Animal Husbandry, Madhya Bharat, Gwalior
42. Sardar Pritam Singh Brar, Superintendent, Veterinary Services, Patiala and East Punjab States Union, Patiala
43. Dr P. M. Narayanaswami Naidu, Director of Animal Husbandry, Mysore, Bangalore
44. Dr G. S. Rathore, Deputy Director of Veterinary, Rajasthan, Jaipur
45. Shri C. N. Dave, Livestock Officer, Saurashtra, Rajkot
46. Shri V. K. Madhava Menon, Director of Veterinary Services, Travancore-Cochin, Trivandrum
47. Shri Harjas Rai, Director of Animal Husbandry, Ajmer
48. Shri C. R. Ranganathan, President, Forest Research Institute and Colleges, Dehra Dun
49. Captain Dalipman Singh, Advocate, Chairman, District Co-operative Bank, Ltd., Ram Niwas, Fatehpur, U.P.
50. Dr C. G. Pandit, Secretary, Indian Council of Medical Research, New Delhi
51. Shri Kunji Lal Dube, Vice-Chancellor, Nagpur University, Nagpur
52. Dr B. L. Manju Nath, Vice-Chancellor, Mysore University, Bangalore
53. Dr V. S. Krishna, Vice-Chancellor, Annamalai University, Waltair
54. Nawab Aliyawar Jung, Vice-Chancellor, Osmania University, Hyderabad-Dn. (Representative, Indian Universities)
55. Shri W. Wilson Mayne, of Messrs Kanan Devan Hills Produce Co. Ltd., Travancore
56. Shri Chimanlal B. Parikh, Representative, Indian Central Cotton Committee, Bombay
57. Shri B. K. Das, M.P., Representative, Indian Central Jute Committee, Calcutta
58. Shri K. P. Pande, M.L.A., Representative, Indian Lac Cess Committee, Ranchi
59. Shri K. P. Madhavan Nair, Representative, Indian Central Coconut Committee, Ernakulam

APPENDIX VI—*contd.*

60. Shri M. Nageswara Rao, Representative, Indian Central Tobacco Committee, Madras
61. Shri Deoji Rattansey, Representative, Indian Central Oilseeds Committee, New Delhi
62. Shri V. R. Krishna Ezhuthassan, Representative, Indian Central Arecanut Committee, Calicut
63. Shri S. N. Ramanna, Representative, Indian Coffee Board, Bangalore
64. Shri K. Srinivasan, Representative, Indian Rubber Board, Kottayam
65. Dr B. N. Chopra, Deputy Fisheries Development Adviser to the Government of India, Ministry of Food and Agriculture, New Delhi (Representative, Fisheries Research Stations)
66. Shri K. R. Damle, I.C.S., Joint Secretary, Ministry of Food and Agriculture, Government of India, New Delhi (Vice-Chairman, Board of Research)
67. Dr H. S. Pruthi, Plant Protection Adviser to the Government of India, Directorate of Plant Protection, Quarantine and Storage, Ministry of Food and Agriculture, New Delhi
68. Dr B. Viswa Nath, Adviser on Agricultural Programmes, Planning Commission, New Delhi
69. Dr P. Parija, Pro-Chancellor, Utkal University, Cuttack
70. Shri Jhunna Singh, Chief Conservator of Forests, Punjab, Simla
71. Dr Baini Prasad, Director of Fisheries, West Bengal, Calcutta
72. Shri J. C. Ryan, Registrar of Co-operative Societies, Madras
73. Shri Kalidas Sawhney, Secretary, Indian Central Cotton Committee, Bombay
74. Shri S. C. Roy, Agricultural Extension Commissioner with the Government of India, New Delhi
75. Shri M. D. Chaturvedi, I.F.S., Inspector-General of Forests, Ministry of Food and Agriculture, Government of India, New Delhi
76. Dr M. D. Patel, Director, Institute of Agriculture, Anand
77. Shri D. H. Duyf, Director and General Manager, The Gwalior Sugar Co., Ltd., Dabra
78. Mrs. Marie Buck, Welfare Officer, Simpson Medical Centre, Madras
79. Shri Nityanand Kanungo, Minister for Law, Home, Planning and Industry, Orissa, Cuttack
80. The Director of Remounts, Veterinary and Farms, Quartermaster General's Branch, Army Head Quarters, Simla
81. Dr S. S. Bhatnagar, Director, Council of Scientific and Industrial Research, New Delhi
82. Shrimati Mira Behn, Pashulok, Rishikesh, U.P.
83. Dr P. C. Mahalanobis, Honorary Statistical Adviser to the Cabinet, New Delhi
84. Shri J. V. A. Nehemiah, Secretary, Indian Council of Agricultural Research

APPENDIX VII

List of members of the Standing Finance Committee

1. Shri Vishnu Sahay, I.C.S., Secretary, Ministry of Food and Agriculture, Government of India, New Delhi
2. Sardar Datar Singh, Vice-President, Indian Council of Agricultural Research, New Delhi
3. Shri M. S. Bhatnagar, Joint Secretary, Ministry of Finance, Government of India and Financial Adviser, Indian Council of Agricultural Research, New Delhi
4. Shri M. P. Patil, Minister for Agriculture, Government of Bombay
5. Shri T. Mariappa, Minister-in-charge of Agriculture, Mysore, Bangalore
6. Shri M. P. Gandhi, c/o Gandhi & Co, Jan Mansion, Sir Pherozshah Mehta Road, Fort, Bombay
7. Shri B. Shiva Rao, M.P., 4, Hardinge Avenue, New Delhi
8. Thakur Bhavani Singh of Pokaran, Pokaran House, Jodhpur
9. Dewan Anand Kumar, Vice-Chancellor, Punjab University, Solan
10. Dr D. R. Bhattacharya, Vice-Chancellor, Allahabad University, Allahabad
11. Shri J. V. A. Nehemiah, Secretary, I.C.A.R., New Delhi

APPENDIX VIII

List of members of the Standing Committee

1. The Hon'ble Shri K. M. Munshi, Minister for Food and Agriculture, Government of India, New Delhi
2. Sardar Datar Singh, Vice-President, Indian Council of Agricultural Research, New Delhi
3. The Hon'ble Shri M. Thirumala Rao, Deputy Minister for Food and Agriculture, Government of India, New Delhi
4. The Hon'ble Shri M. P. Patil, Minister for Agriculture, Government of Bombay, Bombay
5. The Hon'ble Shri T. Mariappa, Minister for Agriculture, Government of Mysore, Bangalore
6. Shri Shankar Prasada, I.C.S., Chief Commissioner, Delhi
7. Shri R. L. Sethi, Agricultural Commissioner with the Government of India, New Delhi
8. Shri P. N. Nanda, Animal Husbandry Commissioner with the Government of India, New Delhi
9. Shri R. G. Sariaaya, Vice-President, Indian Central Cotton Committee, Navsari Chambers, Outram Road, Bombay
10. Dr B. P. Pal, Director, Indian Agricultural Research Institute (Vice-Chairman, Board of Research), New Delhi
11. Shri K. R. Damle, I.C.S., Joint Vice-President, Indian Council of Agricultural Research (Vice-Chairman, Board of Extension), New Delhi
12. Shri M. S. Bhatnagar, Financial Adviser, Indian Council of Agricultural Research (Joint Secretary, Ministry of Finance), New Delhi
13. Dr S. R. Sen, Economic and Statistical Adviser, Ministry of Food and Agriculture, Government of India, New Delhi
14. Shri Tulsidas Kilachand, c/o Kilachand Devchand & Co., 45/47, Appollo Street, Fort, Bombay
15. Thakur Bhawani Singh of Pokaran, Pokaran House, Jodhpur
16. Shri Thakurdas Bhargava, Member, Parliament, 31, Canning Lane, New Delhi
17. Shri J. V. A. Nehemiah, Secretary, Indian Council of Agricultural Research

APPENDIX IX

List of members of the Local Sub-Committee of the Standing Committee

1. The Hon'ble Shri K. M. Munshi, Minister for Food and Agriculture, Government of India, New Delhi. (President)
2. Sardar Datar Singh, Vice-President, Indian Council of Agricultural Research
3. The Hon'ble M. Thirumala Rao, Deputy Minister for Food and Agriculture, Government of India, New Delhi
4. Shri Shankar Prasada, I.C.S., Chief Commissioner, Delhi
5. Shri K. R. Damle, I.C.S., Joint Secretary, Ministry of Food and Agriculture, Government of India (Vice-Chairman, Board of Extension), New Delhi
6. Shri R. L. Sethi, Agricultural Commissioner with the Government of India, New Delhi
7. Shri P. N. Nanda, Animal Husbandry Commissioner with the Government of India
8. Shri M. S. Bhatnagar, Joint Secretary, Ministry of Finance (Financial Adviser, I.C.A.R.), New Delhi
9. Dr S. R. Sen, Economics and Statistical Adviser to the Government of India, New Delhi
10. Dr B. P. Pal, Director, Indian Agricultural Research Institute (Vice-Chairman, Board of Research), New Delhi
11. Shri J. V. A. Nehemiah, Secretary, I.C.A.R., New Delhi

APPENDIX X

List of members of the Board of Research

1. The Hon'ble Shri K. M. Munshi, Minister for Food and Agriculture, Government of India, New Delhi. (Chairman)
2. Sardar Datar Singh, Vice-President, Indian Council of Agricultural Research, New Delhi
3. Shri K. R. Damle, I.C.S., Joint Secretary, Ministry of Food and Agriculture, Government of India (Vice-Chairman, Board of Extension), New Delhi
4. Dr S. R. Sen, Economic and Statistical Adviser to the Government of India, Ministry of Food and Agriculture, New Delhi
5. Shri R. L. Sethi, Agricultural Commissioner with the Government of India, New Delhi
6. Shri P. N. Nanda, Animal Husbandry Commissioner with the Government of India, New Delhi
7. Dr V. G. Panse, Statistical Adviser, Indian Council of Agricultural Research, New Delhi
8. Dr B. P. Pal, Director, Indian Agricultural Research Institute, New Delhi (Vice-Chairman)
9. Dr S. Datta, Director, Indian Veterinary Research Institute, Izatnagar, U.P.
10. Dr K. C. Sen, Director, Indian Dairy Research Institute, Bangalore
11. Dr H. S. Pruthi, Plant Protection Adviser to the Government of India, New Delhi
12. Dr S. Ramanujam, Director, Central Rice Research Institute, Cuttack
13. Dr B. Viswanath, Adviser on Agricultural Programme, Planning Commission, New Delhi
14. Shri Lakshmi Sahay, Director, Animal Husbandry and Veterinary Services, Bombay State, Poona
15. Dr P. Parija, I.E.S. (Retired), 10, Cantonment Road, New Delhi
16. Shri J. V. A. Nehemiah, Secretary, I.C.A.R., New Delhi

APPENDIX XI

List of members of the Board of Extension

1. Sardar Datar Singh, Vice-President, Indian Council of Agricultural Research. (Chairman)
2. Shri K. R. Damle, I.C.S., Joint Secretary, Ministry of Food and Agriculture, Government of India. (Vice-Chairman)
3. Shri R. L. Sethi, Agricultural Commissioner with the Government of India
4. Shri P. N. Nanda, Animal Husbandry Commissioner with the Government of India
5. Dr V. G. Panse, Statistical Adviser, Indian Council of Agricultural Research
6. Dr S. B. Singh, Director of Agriculture, Uttar Pradesh, Lucknow
7. Dr B. N. Uppal, Director of Agriculture, Bombay State, Poona
8. Dr R. L. Kaura, Director of Animal Husbandry, Uttar Pradesh, Lucknow
9. Shri V. R. Rajgopalan, Director of Animal Husbandry, Madras State, Chepauk, Madras
10. Shri Jhunna Singh, Chief Conservator of Forests, Punjab, Simla
11. Dr Baini Prasad, Director of Fisheries, West Bengal, Calcutta
12. Shri J. C. Ryan, Registrar of Co-operative Societies, Madras State, Madras
13. Shri Kalidas Sawhney, Secretary, Indian Central Cotton Committee, Bombay
14. Dr B. Viswanath, Adviser, Agricultural Programme, Planning Commission, New Delhi
15. Shri S. C. Roy, Agricultural Extension Commissioner with the Government of India, New Delhi
16. Shri M. D. Chaturvedi, I.F.S., Inspector-General of Forests, Ministry of Food and Agriculture, Government of India, New Delhi
17. Dr B. P. Pal, Director, Indian Agricultural Research Institute, New Delhi (Vice-Chairman, Board of Research), New Delhi
18. Dr M. D. Patel, Director, Institute of Agriculture, Anand
19. Shri D. H. Duyf, Director and General Manager, The Gwalior Sugar Co. Ltd., Dabra, Gwalior District, Madhya Bharat
20. Mrs. Marie Buck, Welfare Officer, Simpson Medical Centre, Napier Park, Chintadripet, Madras 2
21. Hon'ble Shri Nityanand Kanungo, Minister for Law, Home, Planning and Industry, Orissa, Cuttack
22. Shri J. V. A. Nehemiah, Secretary, Indian Council of Agricultural Research, New Delhi

APPENDIX XII

Personnel of Regional Committees

AGRICULTURAL SIDE

I. *Temperate Himalayan Region*

1. Agricultural Commissioner with the Government of India (Convener and Chairman)
2. Director of Agriculture, Assam, Shillong
3. Director of Agriculture, U.P., Lucknow
4. Director of Agriculture, East Punjab, Simla-East
5. Director of Agriculture, Himachal Pradesh, Simla
6. Director of Agriculture, Kashmir, Srinagar
7. Superintendent, Potato Research Station, Simla
8. Director of Central Potato Research Institute, Patna, Bihar
9. Director of Research, Forest Research Institute, Dehra Dun
10. Dr N. P. Mohan, Conservator of Forests, Himachal Pradesh, Simla
11. Shri Boshi Sen, Director, Vivekananda Laboratory, Almora, U.P.
12. Deputy Fruit Development Adviser to the Government of India, New Delhi
13. Director of Agriculture or Agricultural Officer, Bilaspur (Simla Hills)

II. *Dry Northern Region (Wheat)*

1. Agricultural Commissioner with the Government of India (Convener and Chairman)
2. Director of Agriculture, Punjab, Simla
3. Director of Agriculture, Madhya Pradesh, Nagpur
4. Director of Agriculture, Uttar Pradesh, Lucknow
5. Director of Agriculture, Madhya Bharat, Gwalior
6. Director, Institute of Plant Industry, Indore
7. Director, Indian Agricultural Research Institute, New Delhi
8. Director of Agriculture, Rajasthan, Jaipur
9. Director of Agriculture, PEPSU, Patiala
10. Head of the Division of Engineering, I.A.R.I., New Delhi
11. Director of Agriculture, Vindhya Pradesh, Rewa
12. Director of Agriculture, Saurashtra, Rajkot
13. Director of Agriculture, Bhopal
14. Director of Agriculture or Agricultural Officer, Cutch
15. Assistant Director of Agriculture, Delhi
16. Agricultural Officer, Ajmer
17. Director of Agriculture, Bombay

III. *Eastern Region (Rice)*

1. Agricultural Commissioner with the Government of India (Convener and Chairman)
2. Director of Agriculture, Assam, Shillong
3. Director of Agriculture, West Bengal, Calcutta
4. Director of Agriculture, Patna

APPENDIX XII—*contd.*

5. Director of Agriculture, Cuttack, Orissa
6. Director of Agriculture, Madhya Pradesh, Nagpur
7. Director of Agriculture, U.P., Lucknow
8. Director of Agriculture, Madras
9. Director, Central Rice Research Institute, Orissa, Cuttack .
10. Director, Jute Research Laboratories, Tollygunge, Calcutta
11. Director of Agriculture or Agricultural Officer, Tripura

IV. *Southern Region (Millets)*

1. Agricultural Commissioner with the Government of India (Convener and Chairman)
2. Director of Agriculture, U.P., Lucknow
3. Director of Agriculture, Madhya Pradesh, Nagpur
4. Director of Agriculture, Madhya Bharat, Gwalior
5. Director of Agriculture, Hyderabad-Dn
6. Director of Agriculture, Madras
7. Director of Agriculture, Bombay State, Poona
8. Director of Agriculture, Mysore, Bangalore
9. Director, Indian Institute of Science, Bangalore
10. Director, Institute of Plant Industry, Indore
11. Director of Agriculture, Orissa, Cuttack

V. *Coastal Region*

1. Agricultural Commissioner with the Government of India (Convener and Chairman)
2. Director of Agriculture, Madras
3. Director of Agriculture, Mysore, Bangalore
4. Director of Agriculture, Coorg, Mercara
5. Director of Agriculture, United States of Travancore-Cochin, Trivandrum
6. Director of Agriculture, Bombay State, Poona
7. Director, Indian Institute of Science, Bangalore
8. Dr C. C. John, Director of Research, Travancore, Trivandrum

ANIMAL HUSBANDRY SIDE

I. *Northern Regional Committee*

1. Animal Husbandry Commissioner with the Government of India (Convener and Chairman)
2. Director of Animal Husbandry, U.P., Lucknow
3. Director of Veterinary Services, Punjab, Simla
4. Director of Animal Husbandry & Veterinary Science, Bombay State, Poona
5. Director, Veterinary and Animal Husbandry Services, Madhya Bharat, Gwalior
6. Director of Agriculture, Rajasthan, Jaipur
7. Director of Agriculture, PEPSU, Nabha
8. Director, I.V.R.I., Mukteswar-Kumaon, U.P.
9. Director of Agriculture Saurashtra, Rajkot

APPENDIX XII—*contd.*

10. Animal Husbandry Officer, Kutch, Bhuj
11. Director of Animal Husbandry, Ajmer
12. Director, Agriculture Institute, Anand
13. Animal Husbandry Officer, Bhopal

II. *Southern Regional Committee*

1. Animal Husbandry Commissioner with the Government of India (Convener and Chairman)
2. Director of Animal Husbandry, Chepauk, Triplicane P.O., Madras
3. Director of Animal Husbandry and Veterinary Services, Bombay State, Poona
4. Director of Veterinary Services, Madhya Pradesh, Nagpur
5. Director, Civil Veterinary Department, Hyderabad-Deccan
6. Director, Animal Husbandry, Mysore, Bangalore
7. Director of Dairy Research, Indian Dairy Research Institute, Bangalore
8. Director, Indian Institute of Science, Bangalore

III. *Eastern Regional Committee*

1. Animal Husbandry Commissioner with the Government of India (Convener and Chairman)
2. Director of Animal Husbandry, Chepauk, Triplicane P.O., Madras
3. Assistant Director of Veterinary Services, West Bengal, Calcutta
4. Director of Animal Husbandry, Uttar Pradesh, Lucknow
5. Director of Veterinary Services, Madhya Pradesh, Nagpur
6. Director of Veterinary Services, Bihar, Patna
7. Director, Civil Veterinary Department, Assam, Gauhati
8. Director of Veterinary Services and Animal Husbandry, Orissa, Cuttack
9. Chief Veterinary Officer, Coorg, Mercara
10. Director of Veterinary Services, Travancore-Cochin, Trivandrum
11. Superintendent, Cattle Breeding Research Station, Jubbalpur
12. Prof. J. N. Warner, Allahabad Agricultural Institute, Allahabad
13. Mr. S. K. Sen, Director of Animal Husbandry, Bihar, Patna
14. Major J. M. Lahiri, Principal, Bengal Veterinary College, Calcutta
15. Director of Agriculture, Vindhya Pradesh, Rewa
16. Director of Animal Husbandry and Veterinary Services, Bombay State, Poona

IV. *Temperate Regional Research Committee*

1. Animal Husbandry Commissioner with the Government of India (Convener and Chairman)
2. Director, Animal Husbandry Department, U.P., Lucknow
3. Director of Veterinary Services, Punjab, Simla
4. Director, Civil Veterinary Department, Assam, Gauhati
5. Director, Civil Veterinary Department, Kashmir, Srinagar
6. Mr. J. N. Saini, Animal Husbandry Officer, Himachal Pradesh, Simla
7. Mr. N. P. Mohan, Chief Conservator of Forests, Himachal Pradesh, Simla
8. Director of Agriculture Himachal Pradesh, Simla

APPENDIX XIII

List of members of the Scientific Committees

BOTANY COMMITTEE

1. Dr. B. P. Pal, Head of the Division of Botany, Indian Agricultural Research Institute, New Delhi (Chairman)
2. Shri Boshi Sen, Director, Vivekananda Laboratory, Almora
3. Prof. P. Maheshwari, Head of the Department of Botany, Delhi University, Delhi
4. Prof. Jai Chand Luthra, c/o Shri R. S. Vasudeva, Indian Agricultural Research Institute, New Delhi
5. Dr A. C. Joshi, Professor of Botany, Government College, Hoshiarpur
6. Dr B. C. Kundu, Director, Jute Agricultural Research Institute, Indian Central Jute Committee, Hooghly
7. Dr S. M. Sikka, Cotton Extension Officer, 174, Model Town, Jullundur
8. Dr P. D. Gadkari, Deputy Secretary, Indian Central Cotton Committee, Bombay
9. Shri V. M. Chavan, Deputy Director of Crop Research, Bombay State, Poona
10. Dr T. R. Mehta, Economic Botanist to the Government of Uttar Pradesh, Kanpur
11. Dr H. K. Nandi, Director of Agriculture, West Bengal, Calcutta
12. Shri R. B. Ekbote, Wheat Specialist, Hoshangabad, Madhya Pradesh
13. Dr Bhola Nath, Botanist, Institute of Plant Industry, Indore

Ex-officio members

1. Director, Central Rice Research Institute, Cuttack
2. Officers of the Council

PLANT DISEASES COMMITTEE

1. Dr B. B. Mundkur, Deputy Director, Plant Protection, Directorate of Plant Protection, Quarantine and Storage, Government of India, New Delhi. (Chairman)
2. Dr M. K. Patel, Plant Pathologist to the Government of Bombay, Poona
3. Mycologist to the Government of Madras, Madras
4. Professor of Botany, Poona University, Poona
5. Dr K. D. Bagchee, Mycologist and Acting Forest Botanist, Forest Research Institute, Dehra Dun
6. Dr Raghunath Prasad Asthana, Plant Pathologist and Principal, Agricultural College, Madhya Pradesh, Nagpur
7. Dr P. R. Mehta, Plant Pathologist to the Government of Uttar Pradesh, Lucknow
8. Sayed Vaheeddudin, Plant Pathologist to the Government of Hyderabad, Himayat-Sagar, Hyderabad-Deccan
9. Dr R. S. Vasudeva, Head of the Division of Mycology, Indian Agricultural Research Institute, New Delhi
10. Dr N. Prasad, Institute of Agriculture, Anand, Bombay State

Ex-officio members

1. Officers of the Council

APPENDIX XIII—*contd.*

SOIL SCIENCE COMMITTEE

1. Dr Dalip Singh, Principal, Agricultural College, Punjab, Ludhiana, (Chairman)
2. Dr P. K. Dey, Microbiologist, Government of West Bengal, Calcutta
3. Dr J. A. Daji, Deputy Director of Agriculture (Research and Education), Poona
4. Dr H. N. Mukherjee, Agricultural Chemist, Bihar, Patna
5. Dr J. K. Basu, Soil Physicist to the Government of Bombay, Agricultural College, Poona 5
6. Dr V. Subrahmanyam, Planning Officer, Central Food Technological Research Institute, Mysore
7. Dr H. L. Uppal, Assistant Director (Soil), Central Road Research Institute, Delhi
8. Dr B. K. Mukherjee, Director, Central Sugarcane Research Station, Shahjahanpur
9. Dr T. R. Seshadri, Professor of Chemistry and Head of the Department of Chemistry, Delhi University, Delhi
10. Shri P. D. Karunakar, Principal, Agricultural College, Coimbatore
11. Dr B. Viswanath, c/o Dr B. K. Rac, Opposite Odeon Cinema, New Delhi
12. Dr A. N. Puri, Retired Soil Physicist, East Punjab, 13, Shri Niketan, Queens Road, Bombay

Ex-officio members

1. Dr R. C. Hoon, Deputy Director, Hira Kund Research Station, Sambalpur
2. Head of the Division of Chemistry, Indian Agricultural Research Institute, New Delhi
3. Compost Development Officer, Ministry of Food and Agriculture, New Delhi
4. Dr Girdhari Lal, Assistant Director, Central Food Technological Research Institute, Mysore
5. Officers of the Council

AGRONOMY COMMITTEE

1. Shri R. L. Sethi, Agricultural Commissioner with the Government of India, New Delhi. (Chairman).
2. Dr P. Parija, Pro-Vice-Chancellor, Banaras Hindu University, Banaras
3. Shri Kali Das Sawhney, Secretary, Indian Central Cotton Committee, Bombay
4. Dr A. T. Sen, Member, Public Service Commission, Calcutta
5. Shri D. A. Gadkari, Joint Director of Agriculture (Engineering), Bombay State, Poona
6. Shri J. Bannerjee, Deputy Inspector-General of Forests, Ministry of Food and Agriculture, New Delhi
7. Shri B. N. Handa, Principal, Government Veterinary College, Hissar
8. Dr R. Sankaran, Institute of Plant Industry, Indore
9. Dr R. J. Kalamkar, Director of Agriculture, Madhya Pradesh, Nagpur
10. Dr T. J. Mirchandani, Head of the Agronomy Division, Indian Agricultural Research Institute, New Delhi

APPENDIX XIII—*contd.*

11. Shri R. V. Ramiah, Head of the Division of Agricultural Engineering, I.A.R.I., New Delhi
12. Dr L. A. Ramdas, Director of Agricultural Meteorology, Poona
13. Shri S. C. Roy, Director of Intensive Cultivation, Ministry of Food and Agriculture, New Delhi

Ex-officio members

1. Officers of the Council

ENTOMOLOGY AND ANIMAL PESTS OF CROPS COMMITTEE

1. Dr Hem Singh Pruthi, Plant Protection Adviser to the Government of India, Directorate of Plant Protection and Storage, New Delhi. (Chairman)
2. Dr K. B. Lal, Entomologist to the Government of Uttar Pradesh, Kanpur
3. Dr K. N. Trehan, Entomologist to the Government of Punjab, Ludhiana
4. Shri S. Ramachandran, Entomologist to the Government of Madras, Coimbatore
5. Dr G. A. Patel, Entomologist to the Government of Bombay, College of Agriculture, Poona 5
6. Dr M. S. Mani, Professor of Zoology, St. John's College, Agra
7. Shri R. N. Mutto, Honorary General Secretary, All-India Bee Keepers' Association, Ramgarh, P.O., District Nainital, U.P.
8. Dr R. L. Gupta, Entomologist to the Government of Madhya Pradesh, College of Agriculture, Nagpur
9. Syed Wajid Hussain, Honey Development Officer, U.P., Chhota Jafar Manzil, V.N. Verma Road, Lucknow

Ex-officio members

1. Mr. K. R. Sontakay, Director of Storage, Storage Directorate, Ministry of Food and Agriculture (Food), New Delhi
2. Dr. E. S. Narayanan, Head of the Division of Entomology, Indian Agricultural Research Institute, New Delhi
3. Officers of the Council

ANIMAL BREEDING COMMITTEE

1. Shri P. N. Nanda, Animal Husbandry Commissioner with the Government of India, New Delhi. (Chairman)
2. Dr M. D. Patel, Director, Institute of Agriculture, Anand
3. Shri S. K. Sen, Animal Husbandry Officer, Bihar, Patna
4. The Superintendent, Government Livestock Farm, Hissar
5. Shri H. B. Shahi, Officer on Special Duty, U.P. Government, Lucknow
6. The Director of Veterinary Department, Hyderabad State, Hyderabad-Dn
7. Shri V. L. Wazir, Director of Civil Veterinary Department, Jammu and Kashmir State, Srinagar
8. Shri R. L. Kaura, Director of Animal Husbandry, U.P., Lucknow
9. Dr P. Bhattacharya, Head of the Division of Animal Genetics, Indian Veterinary Research Institute, Izatnagar

APPENDIX XIII—*contd.*

10. Shri G. B. Singh, Director of Animal Husbandry and Veterinary Services, Orissa, Cuttack

Ex-officio members

1. The Head of the Division of Agriculture, Indian Agricultural Research Institute, New Delhi
2. The Registrar, Central Herd Books, I.C.A.R. (The Post of D.L.A. has been abolished by the Government of India)
3. Officers of the Council

DAIRY SCIENCE COMMITTEE

1. Dr K. C. Sen, Director of Dairy Research, Indian Dairy Research Institute, Bangalore-1. (Chairman)
2. Mr. B. N. Banerjee, Indian Institute of Science, Bangalore-3
3. Prof. J. N. Warner, Allahabad Agricultural Institute, Allahabad
4. Sardar Harbans Singh, Assistant Cattle Utilization Adviser, Ministry of Food and Agriculture, New Delhi
5. Shri N. K. Bhargava, Dairy Development Officer, U.P., Lucknow
6. The Director, Remounts, Veterinary & Farms, General Headquarters, Simla (or his representative)
7. Shri D. N. Khurody, Milk Commissioner, Wakefield House, Ballard Estate, Fort, Bombay
8. Dr L. C. Sikka, Milk Commissioner-cum-Administrator, Haringhatta Farm, Government of West Bengal, Writers Buildings, Calcutta
9. Shri Harjas Rai, Director of Animal Husbandry, Ajmer-Merwara, Ajmer

Ex-officio members

1. Officers of the Council

ANIMAL NUTRITION COMMITTEE

1. Dr K. C. Sen, Director of Dairy Research, Indian Dairy Research Institute, Bangalore-1. (Chairman)
2. Dr G. Sankaran, c/o Indian Penicillin Committee, Bombay
3. Dr Lal Chand Dharmani, Agricultural Chemist, Agriculture Department, Punjab, Jullundur City
4. Dr N. D. Kehar, Head of the Division of Animal Nutrition, Indian Veterinary Research Institute, Izatnagar, U.P.
5. Dr S. P. Srivastava, Research Officer, Animal Nutrition Section, Government Cattle Farm, Bharari P.O., Jhansi (U.P.)
6. Dr V. N. Patwardhan, Director, Nutrition Research Laboratory, Coonoor, South India
7. Major T. Murari, Joint Director of Animal Husbandry, Triplicane, Madras
8. Shri P. G. Pande, Principal, College of Veterinary Science & Animal Husbandry, Mathura, U.P.
9. Dr S. K. Talapatra, Professor of Animal Nutrition, College of Veterinary Science & Animal Husbandry, Mathura, U.P.

APPENDIX XIV—*contd.**Ex-officio members*

1. The Director, Indian Veterinary Research Institute, Izatnagar, U.P.
2. Officers of the Council

ANIMAL DISEASES AND PESTS COMMITTEE

1. Dr S. Datta, Director, Indian Veterinary Research Institute, Izatnagar, U.P. (Chairman)
2. Shri V. R. Rajagopalan, Director of Animal Husbandry, Madras, P.O. Triplicane, Madras
3. Shri L. Sahai, Director of Veterinary Services, Bombay State, Poona
4. Prof. M. Y. Mangrulkar, Director of Veterinary Services, Madhya Pradesh, Nagpur
5. Dr G. S. Thapar, Reader in Zoology, Lucknow University, Lucknow
6. Shri M. I. Malik, Director of Veterinary Services, Bihar, Patna
7. Shri M. R. Dhanda, Research Officer, Indian Veterinary Research Institute, Mukteswar-Kumaon, U.P.
8. The Director of Remounts, Veterinary & Farms in India, Defence Headquarters, Simla
9. Dr H. D. Srivastava, Research Officer (Helminthology), I.V.R.I., Izatnagar, U.P.
10. Dr P. M. Narainswamy Naidu, Director of Animal Husbandry, Mysore State, Bangalore
11. Shri P. C. Banerji, Assistant Director of Veterinary Services, West Bengal, 8, Lyons Range, Calcutta
12. Dr B. C. Basu, Research Officer (Entomology), Indian Veterinary Research Institute, Izatnagar, U.P.
13. Dr H. N. Ray, Head of the Division of Parasitology, Indian Veterinary Research Institute, Mukteswar-Kumaon, U.P.

Ex-officio members

1. Officers of the Council

STATISTICAL COMMITTEE

1. Shri K. R. Damle, I.C.S., Joint Vice-President, Indian Council of Agricultural Research, New Delhi. (Chairman)
2. Prof. P. C. Mahalanobis, Honorary Statistical Adviser to the Cabinet, Secretariat, New Delhi
3. Dr R. J. Kalamkar, Director of Agriculture, Madhya Pradesh, Nagpur
4. Shri R. S. Koshal, Statistician, Department of Agriculture, Bombay State, Poona-5
5. Dr K. Kishan, Chief Statistician, Department of Agriculture, Uttar Pradesh, Lucknow
6. Prof. V. D. Thawani, Professor of Statistics, Gauhati University, Assam
7. Dr N. S. R. Sastry, Director of Statistics, Reserve Bank of India, Bombay
8. Dr U. S. Nair, Superintendent, Census Operations, Travancore-Cochin, Trivandrum

APPENDIX XIII—*contd.*

9. Dr S. R. Sen, Economic and Statistical Adviser, Directorate of Economics and Statistics, Ministry of Food and Agriculture, Government of India, New Delhi
10. Dr C. R. Rao, Indian Statistical Institute, Calcutta

Ex-officio members

1. Officers of the Council

PUBLICATIONS COMMITTEE

1. Shri Datar Singh, Vice-President, Indian Council of Agricultural Research, New Delhi. (Chairman)
2. Joint Vice-President, I.C.A.R., New Delhi
3. Agricultural Commissioner with the Government of India
4. Animal Husbandry Commissioner with the Government of India
5. Director, Indian Agricultural Research Institute, New Delhi
6. Director, Indian Veterinary Research Institute, Mukteswar, U.P.
7. Director, Indian Dairy Research Institute, Bangalore
8. Plant Protection Adviser to the Government of India
9. Dr S. B. Singh, Director of Agriculture, Uttar Pradesh, Lucknow
10. Shri H. B. Shahi, Officer on Special Duty, Government of U.P., Lucknow
11. Dr P. Parija, 10, Cantonment Road, Cuttack
12. Director of Publicity, Ministry of Food and Agriculture, New Delhi
13. Secretary, I.C.A.R., New Delhi
14. Editor, I.C.A.R., New Delhi

EDITORIAL BOARD FOR INDIAN JOURNAL OF AGRICULTURAL SCIENCE

1. Agricultural Commissioner with the Government of India
2. Director, Indian Agricultural Research Institute, New Delhi
3. Shri M. S. Randhawa, Director General of Rehabilitation, Punjab, Jullundur
4. Statistical Adviser, I.C.A.R., New Delhi
5. Editor, I.C.A.R., New Delhi

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1. Animal Husbandry Commissioner with the Government of India
2. Director, Indian Veterinary Research Institute, Mukteswar
3. Director, Indian Dairy Research Institute, Bangalore
4. Prof. J. N. Warner, Head of the Department of Animal Husbandry and Dairying, Allahabad Agricultural Institute, Allahabad
5. Editor, I.C.A.R., New Delhi

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1. Vice-President, I.C.A.R., New Delhi
2. Agricultural Commissioner with the Government of India
3. Animal Husbandry Commissioner with the Government of India
4. Secretary, I.C.A.R., New Delhi
5. Editor, I.C.A.R., New Delhi

APPENDIX XIII—*contd.*

EDITORIAL BOARD FOR OCCASIONAL PUBLICATIONS

1. Agricultural or Animal Husbandry Commissioner with the Government of India
2. Secretary, I.C.A.R., New Delhi
3. Editor, I.C.A.R., New Delhi

EDITORIAL COMMITTEE FOR INDIAN FARMING

1. Shri K. R. Damle, Joint Vice-President, I.C.A.R., New Delhi. (Chairman)
2. Dr S. R. Sen, Economic and Statistical Adviser, Ministry of Food and Agriculture, New Delhi
3. Dr B. P. Pal, Director, I.A.R.I., New Delhi
4. Shri A. R. Vyas, Director of Publicity, Ministry of Food and Agriculture (Agri.), New Delhi
5. Dr K. Mitra, Assistant Director-General of Health Services, Ministry of Health, New Delhi
6. Shri H. C. Holmes, Agricultural Extension Expert, Ministry of Food and Agriculture, New Delhi
7. Dr U. N. Chatterjee, Editor, I.C.A.R., New Delhi

EDITORIAL BOARD FOR KHETI

1. Vice-President, I.C.A.R., New Delhi
2. Assistant Agricultural Commissioner with the Government of India
3. Assistant Animal Husbandry Commissioner with the Government of India
4. Secretary, I.C.A.R., New Delhi
5. Editor, I.C.A.R., New Delhi
6. Assistant Editor (Kheti), I.C.A.R., New Delhi

STANDING COMMITTEE OF AGRONOMISTS, CHEMISTS AND STATISTICIANS

1. Shri Datar Singh, Vice-President, Indian Council of Agricultural Research. (Chairman)
2. Agricultural Commissioner with the Government of India, New Delhi
3. Director of Agriculture, U.P., Lucknow
4. Director of Agriculture, Hyderabad-Deccan
5. Dr H. N. Mukherjee (Chemist), Bihar
6. Principal, Agricultural College, Ludhiana
7. Dr V. G. Panse, Statistical Adviser, Indian Council of Agricultural Research, New Delhi
8. Dr P. V. Sukhatme, Chief, Statistics Branch, F.A.O., Rome
9. Dr J. A. Daji, Agricultural Chemist to the Government of Bombay, Poona
10. Dr K. Kishen, Statistician, Department of Agriculture, Uttar Pradesh, Lucknow
11. Secretary, Indian Council of Agricultural Research

APPENDIX XIII—*contd.*

Ad-hoc COMMITTEE OF THE ANIMAL DISEASES AND PESTS COMMITTEE (to co-ordinate and guide Helminthological Research in India)

1. Dr H. D. Srivastava, Helminthologist, Indian Veterinary Research Institute, Izatnagar. (Chairman)
2. Dr G. S. Thapar, Officer-in-Charge, Helminthiasis Scheme, Lucknow University, Lucknow.
3. Shri L. Sahai, Director of Animal Husbandry and Veterinary Services, Bombay
4. Shri M. Anantaraman, Research Officer, Helminthiasis Scheme, Madras
5. Shri G. S. Kulkarni, Officer-in-charge, Liver-fluke Control Scheme, Nizamabad, Hyderabad, Deccan
6. Shri S. K. Bhaduri, Assistant Disease Investigation Officer, West Bengal, Calcutta

Ad-hoc MILK COSTING COMMITTEE (to work out the detailed plan of work of the scheme on ascertaining the Cost of Milk Production)

1. Dr V. G. Panse, Statistical Adviser, Indian Council of Agricultural Research, New Delhi. (Chairman)
2. Dr S. R. Sen, Economic and Statistical Adviser, Ministry of Food and Agriculture, Government of India, New Delhi
3. Prof. J. N. Warner, Head of the Department of Dairying, Allahabad Agricultural Institute, Allahabad
4. Shri Y. U. Salpekar, Milk Costing Officer, Bombay
5. Shri H. C. Verma, Deputy Dairy Development Adviser to the Government of India, Ministry of Food and Agriculture, New Delhi

Ad-hoc COMMITTEE FOR FINALISING THE TECHNIQUE FOR ASSESSING THE RESULTS OF GROW MORE FOOD CAMPAIGN

1. Dr V. G. Panse, Statistical Adviser, I.C.A.R., New Delhi. (Chairman)
2. Dr P. V. Sukhatme, Chief, Statistics Branch, F.A.O. of the U.N.O., Rome
3. Shri N. C. Chakravarti, Assistant Secretary to the Government of West Bengal, Department of Agriculture, Forests and Fisheries, Calcutta
4. Shri R. S. Koshal, Statistician, Department of Agriculture, Bombay State, Poona
5. Shri K. Kishen, Chief Statistician, Department of Agriculture, Uttar Pradesh, Lucknow
6. Director of Agriculture (or his Deputy), Madhya Pradesh, Nagpur

Ad-hoc WOOL SAMPLING COMMITTEE

1. Dr V. G. Panse, Statistical Adviser, Indian Council of Agricultural Research, New Delhi. (Chairman)
2. Dr P. V. Sukhatme, Chief, Statistics Branch, F.A.O. of the U.N.O., Rome
3. Dr A. K. Deshpande, Sheep Breeding Statistician, Poona
4. Shri R. S. Koshal, Statistician, Department of Agriculture Government of Bombay, Poona

APPENDIX XIII—*contd.**Ad-hoc* COMMITTEE ON FISHERIES

1. Dr B. N. Chopra, Deputy Fisheries Development Adviser to the Government of India. (Chairman)
2. Dr S. L. Hora, Director, Zoological Survey of India
3. Dr Baini Prashad, Director of Fisheries, West Bengal
4. Assistant Director of Fresh Water Fisheries, Madras
5. Dr R. L. Kaura, Director of Animal Husbandry and Fisheries, Uttar Pradesh, Lucknow

Ad-hoc COMMITTEE TO ENQUIRE INTO THE WORKING OF THE LIVESTOCK INVESTIGATION SCHEME, HISSAR

1. Shri M. R. Mahajan, Assistant Animal Husbandry Commissioner, I.C.A.R., New Delhi. (Chairman)
2. Dr S. S. Prabhu, Research Officer, Animal Genetics Section, I.V.R.I., Izatnagar
3. Shri A. R. Roy, Statistician (A.H.), I.C.A.R., New Delhi
4. Superintendent, Livestock Research Station, Hissar

THE SUB-COMMITTEE ON INDIGENOUS DRUGS

1. Dr S. Datta, Director, I.V.R.I., Mukteswar, Kumaon. (Chairman)
2. Director, Central Drug Research Institute, Lucknow
3. Dr K. Biswas, Superintendent, Botanical Gardens, Calcutta
4. Professor of Pharmacology, Madras Veterinary College, Madras
5. Professor of Pharmacology, Bihar Veterinary College, Patna
6. Shri A. Krishnaswamy, Research Officer for Collection of Records of Indigenous Drugs used in Veterinary Practice (Retired), 1/18, Luz Avenue, Mylapore, Madras
7. Dr Viswerwara Sastri, Professor of Clinical Research, College of Indigenous Medicine, Madras
8. Pandit Thakur Dutt Multani, Ayurvedic Medical Practitioner, Connaught Place, New Delhi
9. Dr Shukla, Retired Medical Health Officer, Ajmer, Ajmer Municipality, Shukla Bhawan, Pushkar Road, Ajmer

Ex-officio members

1. Shri A. P. Mathur, Under Secretary, (Representative of the Ministry of Commerce, Government of India)
2. Agricultural Marketing Adviser to the Government of India or his representative
3. Shri M. N. Kale, Assistant Development Officer, Development Wing, Ministry of Commerce and Industry (Representative of the Ministry of Commerce and Industry)
4. Officers of the Council

APPENDIX XIII—*contd.*

LIVESTOCK, MILK AND POULTRY COMMITTEE

1. Shri P. N. Nanda, Animal Husbandry Commissioner with the Government of India, New Delhi. (Chairman)
2. Shri J. N. Mankar, Secretary, Bombay Humanitarian League, 149, Shroff Bazar, Bombay-2
3. Rai Bajrang Bahadur Singh, M.L.C., Bhadri House, 3, Shahjahan Road, Lucknow
4. Shri Nalla Senapathi Sarkarai Manradiar, Pattagar of Palayakottai, Palayakottai P.O., *via* Erodo, Coimbatore District (S.I. Rly.)
5. Shri Satish Chandra Das Gupta, Khadi Pratisthan, P.O. Sodepur, 24, Parganas, West Bengal
6. Shri Y. M. Parnerkar, Honorary Livestock Adviser, Government of Madhya Pradesh, Nagpur
7. Shree Heera Lal Patel, (Representative of the Rajasthan Union)
8. Shri A. E. Slater, Mission Poultry Farm, Etah, U.P.
9. Shri Purviz Nariman Kothawala, Ellis Bridge, Ahmedabad
10. Shri Uddhab Patnaik, Livestock Officer, Orissa, Cuttack
11. Shri Dharma Lal Singh c/o The Darbhanga Goshala Society, Darbhanga, Bihar
12. Shri T. N. Singh, Member, Parliament, Ferozshah Road, New Delhi
13. Shri S. G. Iyer, Officer-in-charge, Poultry Research Committee, Indian Veterinary Research Institute, Izatnagar

Ex-officio members

1. Deputy Dairy Development Adviser to the Government of India, Ministry of Agriculture, New Delhi
2. Director-General of Health Services, Government of India, New Delhi
3. Officers of the Council
4. Agricultural Marketing Adviser to the Government of India

APPENDIX XIV

List of members of the Commodity Committees

FOOD GRAINS COMMITTEE

1. Shri R. L. Sethi, Agricultural Commissioner with the Government of India. (Chairman)
2. Shri C. Bali Reddi, Cumbum P.O., Kurnool District, Madras
3. Shri Ashutosh Bhattacharya, Bengal Rice Mills and Merchants Association, 30, Kabir Road, Calcutta
4. Shri P. R. Deshmukh, M.P., District Amraoti, Madhya Pradesh
5. Shri V. S. Thyagaraja Mudaliar, Landlord, Vadapathi, Mangalam, Tanjore, Madras
6. Sardar Iqbal Singh, Aira Estate, Kheri District, U.P.
7. Director of Agriculture, Madhya Bharat, Gwalior
8. Shri G. N. Rangaswamy Iyengar, Rama Mandiram, 4, Ramaswami Street, Thyagarayanagar, Madras-17
9. Shri T. R. Mehta, Economic Botanist to the Government of U.P., Kanpur
10. Shri S. Ramanujam, Director, Central Rice Research Institute, Cuttack
11. Dr V. N. Patwardhan, Director, Nutrition Research Laboratory Coonoor, S. India
12. Director of Agriculture, Rajasthan, Jaipur
13. Shri P. D. Dixit, Assistant Director of Agriculture (Seed Multiplication Scheme), Government of Orissa, Cuttack

Ex-officio members

1. Shri K. R. Sontakay, Director of Storage, Ministry of Food and Agriculture, New Delhi
2. Officers of the Council

MEDICINAL PLANTS COMMITTEE

1. Shri R. L. Sethi, Agricultural Commissioner with the Government of India, New Delhi. (Chairman)
2. Dr B. B. Dikshit, Principal, B. J. Medical College, Poona. (Representative, Indian Council of Medical Research)
3. Shri R. L. Badhwar, Forest Research Institute, Dehra Dun
4. Dr K. Biswas, Superintendent, Botanical Garden, Calcutta
5. Dr B. M. Ghose, Messrs Union Drug Co., Ltd., 285, Bowbazar Street, Calcutta (Representative of the Pharmaceutical Industry in India nominated by the Indian Chemical Manufacturers Association)
6. Dr B. Mukherjee, Director, Central Drugs Control Laboratory, Calcutta.
7. Dr K. Ganapathi, Haffkine Institute, Bombay. (Representative of the Haffkine Institute)
8. Dr B. P. Pal, Director, Indian Agricultural Research Institute, New Delhi
9. Dr M. S. Verma, Principal, Ayurvedic College, Banaras

APPENDIX XIV—*contd.*

10. Director/Assistant Director, Central Drug Research Institute, C.S. & I.R., Lucknow
11. Dr S. Dutta, Director, I.V.R.I., Izatnagar
12. Mr. P. M. Nabar, representative of the Ministry of Health, Government of India, New Delhi

FRUITS AND VEGETABLES COMMITTEE

1. Shri R. L. Sethi, Agricultural Commissioner with the Government of India, New Delhi. (Chairman)
2. The Fruit Specialist to the Government of Punjab, Jullundur
3. The Horticulturist to the Government of Madhya Pradesh, In-charge, Citrus Fruit Research Scheme, V.T.I. Building, Maharajbagh, Nagpur (Madhya Pradesh)
4. Shri K. C. Naik, Headquarters Deputy Director of Agriculture, Government of Madras, Madras
5. Deputy Director of Horticulture, U.P., Butler Palace, Lucknow, U.P.
6. Horticulturist to the Government of Bombay, Poona
7. Director of Agriculture, Jammu and Kashmir State, Srinagar
8. Shri M. L. Garg, c/o L. R. Brothers, Seedsmen and Nurserymen, Saharanpur, U.P.
9. Shri Krishna Parsad Bhargava, Proprietor, G. G. Fruit Preserving Factory, Agra (U.P.)
10. Dr G. S. Cheema, Village Jhand, P.O. Dasuya, District Hoshiarpur, Punjab
11. Shri V. Hanumanthu Naidu, Ellampot P.O., via Nandalur, Cuddapah Distt., Madras State
12. Shri N. Y. Kashalkar, Chief Production Manager. Central Hindustan Orange and Cold Storage Co., Ltd., P.B. No. 53, (Motibagh), Nagpur, Madhya Pradesh
13. Dr S. Ramanujam, Director, Central Rice Research Institute, Cuttack, Orissa
14. Shri S. C. Battacharjee, Horticultural Development Officer, Assam, Gauhati

Ex-officio members

1. Dr D. V. Karmarkar, Technical Adviser, Representative of the Ministry of Food and Agriculture, Government of India, New Delhi
2. Agricultural Marketing Adviser to the Government of India or his representative, Directorate of Marketing and Inspection, Ministry of Food and Agriculture, New Delhi
3. Head of the Division of Botany, Indian Agricultural Research Institute, New Delhi
4. Officers of the Council
5. Dr Girdhari Lal, Central Institute of Fruit Technology, Council of Scientific and Industrial Research, Mysore. (To be invited to attend a meeting if items of the agenda require his presence)

APPENDIX XIV—*contd.*

HIDES AND SKINS COMMITTEE

1. Shri Mohd. Hamza, Chairman, Tanners Federation of India, U.P. Tannery, Kanpur
2. Vacant
3. Shri N. Ramalingoswara Rao, 26, Burkitt Road, Thyagarajanagar, Madras 17
4. Shri T. Jiyar Das, Vice-President of the All-India Depressed Class League, Nidubrolu, S.I. Rly.
5. Principal, Institute of Leather Technology, Washermempet, Madras-21
6. Shri B. M. Das, O.S.D., Central Leather Research Institute, Madras
7. Mr. O. G. Mayor of Messrs A. E. Bluementhal, Punjab House, P-39, Princep Street, Calcutta
8. Shri R. K. Mirza, Representative, Kashmir Export Co., Dal Gate, Srinagar
9. Shri B. N. Soni, Officer-in-charge, Hides and Skins Research Schemes, Indian Veterinary Research Institute, Mukteswar
10. Mohd. Fariq, Honorary Secretary, Arhathdar Hide Merchants Association, Peach Bagh, Kanpur (or his representative)

Ex-officio members

1. Agricultural Marketing Adviser to the Government of India, Ministry of Food and Agriculture, New Delhi
2. Chief Controller of Exports and Imports, Ministry of Commerce and Industry, Government of India, New Delhi
3. Shri P. C. Basu, Development Officer (Leather), Development Wing, Ministry of Commerce and Industry, Shahjahan Road, New Delhi
4. Officers of the Council

WOOL COMMITTEE

1. Shri P. N. Nanda, Animal Husbandry Commissioner with the Government of India, New Delhi. (Chairman)
2. Shri S. S. Khot, Sheep and Wool Development Officer, Bombay, Poona
3. Dr B. K. Vaidya, Assistant Director, Ahmedabad Textile Industry's Research Association, Textile Research Institute, Ahmedabad
4. Mr. A. Staynes, International Wool Secretariat, Shahjahan Road, New Delhi
5. Shri B. K. Sinha, General Manager, Messrs Jayantilal Sunderji & Co., Wool Exporters, Fazilka, Representative of Fazilka Wool Merchants' Association, Fazilka
6. Shri P. V. Kanitkar, Secretary, All-India Spinners' Association, Kashmir Branch, Srinagar, (Representative of All-India Spinners' Association, Kashmir Branch)

APPENDIX XIV—*contd.*

7. Shri Vijaysingh, M/s. Vijaysingh and Co., 13/21, 3rd Panjrapole Lane, Bombay (Representative of the Bombay Wool Merchants' Association)
8. Master Mohan Lal Mandot, c/o Messrs Gulabchand Inderchand, Wool Merchants, Mewari Bazar, Beawar, Ajmer, (Representative of Beawar Wool Merchants' Association)
9. Shri N. L. Narayan, Sheep and Wool Development Officer, Rajasthan, Jaipur
10. Shri Manoobhai Doongursoo, c/o Doongursoo & Sons, Manekhi Building, 127, Mahatma Gandhi Road, P.B. 890, Fort, Bombay
11. Shri Sirey Mal Kanther, Wool Merchant, Udaipuria Bazar, Pali (Marwar) (Representative of Pali Wool Traders, Rajasthan)
12. Director, Indian Standards Institution, Delhi
13. Superintendent, Government Livestock Farm, Hissar

APPENDIX XV

List of members of the Ad hoc Committees and Sub-Committees

STANDING COMMITTEE OF AGRONOMISTS, CHEMISTS AND STATISTICIANS

(For the consideration of the co-ordinated scheme on varietal, agronomic and manurial trials prepared on the recommendations of Dr Stewart's report)

1. Vice-President, Indian Council of Agricultural Research
2. Agricultural Commissioner with the Government of India, New Delhi
3. Director of Agriculture, U.P., Lucknow
4. Director of Agriculture, Hyderabad-Deccan
5. Dr H. N. Mukherjee (Chemist), Bihar
6. Principal, Agricultural College, Ludhiana
7. Dr V. G. Panse, Statistical Adviser, Indian Council of Agricultural Research, New Delhi
8. Dr J. A. Daji, Agricultural Chemist to the Government of Bombay, Poona
9. Dr K. Kishen, Statistician, Department of Agriculture, Uttar Pradesh, Lucknow
10. Secretary, Indian Council of Agricultural Research
11. Dr P. V. Sukhatme, Chief of the Statistical Division of the Food and Agriculture Organisation of the U.N.O., Rome

Ad-hoc COMMITTEE OF THE ANIMAL DISEASES AND PESTS COMMITTEE (to co-ordinate and guide Helminthological Research in India)

1. Dr H. D. Srivastava, Helminthologist, Indian Veterinary Research Institute, Izatnagar
2. Dr G. S. Thapar, Officer-in-charge, Helminthiasis Scheme, Lucknow University, Lucknow
3. Shri L. Sahai, Director of Animal Husbandry and Veterinary Services, Bombay
4. Shri M. Anantaraman, Research Officer, Helminthiasis Scheme, Madras
5. Shri G. S. Kulkarni, Officer-in-charge, Liver-fluke Control Scheme, Nizamabad, Hyderabad, Deccan
6. Shri S. K. Bhaduri, Assistant Disease Investigation Officer, West Bengal, Calcutta

Ad-hoc COMMITTEE FOR THE CONSIDERATION AND REVISION OF VISHWABHARATI SCHEME FOR AGRONOMIC DEVELOPMENT OF RURAL AREA IN WEST BENGAL

1. Agricultural Commissioner with the Government of India, New Delhi. (Chairman)
2. Joint Vice-President, Indian Council of Agricultural Research
3. Animal Husbandry Commissioner with the Government of India, New Delhi
4. Agricultural Extension Commission, I.C.A.R., New Delhi
5. Director, Indian Agricultural Research Institute, New Delhi
6. Director of Agriculture, West Bengal, Calcutta
7. Shri Rathindir Nath Tagore (a representative of Vishwabharati University)

APPENDIX XV—*contd.**Ad-hoc* MILK COSTING COMMITTEE TO WORK OUT THE DETAILED PLAN OF WORK OF THE SCHEME ON ASCERTAINING THE COST OF MILK PRODUCTION

1. Statistical Adviser, Indian Council of Agricultural Research, New Delhi. (Chairman)
2. Dr S. R. Sen, Economic and Statistical Adviser, Ministry of Food and Agriculture, Government of India, New Delhi
3. Prof. J. N. Warner, Head of the Department of Dairying, Allahabad, Agricultural Institute, Allahabad
4. Shri Y. U. Salpekar, Milk Costing Officer, Bombay
5. Shri H. C. Verma, Deputy Dairy Development Adviser to the Government of India, Ministry of Food and Agriculture, New Delhi

Ad-hoc COMMITTEE FOR FINALISING THE TECHNIQUE FOR ASSESSING THE RESULTS OF GROW MORE FOOD CAMPAIGN

1. Dr P. V. Sukhatme, Chief, Statistics Branch, F.A.O. of the U.N.O., Rome
2. Dr V. G. Panse, Statistical Adviser, I.C.A.R., New Delhi
3. Shri N. C. Chakravarti, Assistant Secretary to the Government of West Bengal, Department of Agriculture, Forests and Fisheries, Calcutta.
4. Shri R. S. Koshal, Statistician, Department of Agriculture, Bombay State, Poona
5. Shri K. Kishen, Chief Statistician, Department of Agriculture, Uttar Pradesh, Lucknow
6. The Director of Agriculture (or his Deputy), Madhya Pradesh, Nagpur

APPENDIX

Annual Accounts of Income and Expenditure of the Indian

RECEIPTS			
Head of Account	Receipts during the year	G R A N T S	
		Original	Net
	Rs.	Rs.	Rs.
I. Opening Balance	3,85,297 2 5	29,000	31,900
II. Receipts under the Agriculture Produce Cess Act	44,24,072 0 0	9,000	15,200
III. Grants from the			
(a) Indian States	..	24,000	12,700
(i) Kashmir	5,000 0 0	1,000	1,400
(ii) Travancore-Cochin	5,000 0 0	3,000	6,700
(iii) Rajasthan (Jaipur)	20,000 0 0	..	1,500
(iv) Saurashtra	20,000 0 0	..	16,500
	50,000 0 0		
(b) The Central Government for Crop Cutting Experiment on Jute	18,500 0 0	..	..
(c) The States' share of Food Bonus of Crop Cutting Experiments	1,43,643 0 0	..	..

XVI

Council of Agricultural Research for the year 1951-52

PAYMENTS

Head of Account	Expenditure during the year	Excess (—) or saving (+) over net grant	Remarks
	Rs.	Rs.	
A—STANDING CHARGES			
1. Accounts & Audit	32,164 3 6	(—)264 3 6 (a)	(a) Inconsiderable
2. Travelling allowance of non-official members of the Council	15,155 2 0	(+)44 14 0 (a)	
3. Travelling allowance of members of the Committees of the Advisory Board and of other persons invited to attend the meetings	12,310 11 0	(+)389 5 0 (a)	
4. Travelling allowance of members of the Committee, non-official members of the Board of Agriculture and Animal Husbandry in India	1,130 9 0	(+)269 7 0 (b)	(b) Less actual expenditure than was anticipated
5. Miscellaneous ..	7,690 7 6	(—)990 8 6 (c)	(c) Excess due to actual expenditure connected with meetings exceeding estimate
B—RESEARCH, TRAINING AND PUBLICITY UNDER DIRECT CONTROL OF I.C.A.R.			
(i) <i>Agriculture</i>			
1. Indian Institute of Fruit Technology	1,563 10 0	(—)3 10 0 (a)	
2. Description of different varieties of fruits	16,378 2 9	(+)121 13 3 (a)	

APPENDIX

Annual Accounts of Income and Expenditure of the Indian

RECEIPTS					G R A N T S	
Head of Account				Receipts during the year	Original	Net
				Rs.	Rs.	Rs.
IV. Interest from investments				..	..	8,600
(i)	2 $\frac{3}{4}$ % loan, 1962	..	..	26,059 8 0	..	..
(ii)	3% loan, 1963-65	..	..	49,361 4 0	..	..
(iii)	3% 2nd Victory Loan, 1959-61	..	..	14,962 8 0	..	..
(iv)	3% Victory Loan, 1957	..	..	55,596 12 0	..	10
(v)	Fixed Deposits, etc.	..	..	70,772 13 7	..	..
(vi)	2 $\frac{1}{2}$ % loan, 1955	..	..	19,913 12 0	..	..
(vii)	2 $\frac{1}{4}$ % loan 1954	..	..	16,951 12 0	..	..
				2,53,568 5 7		
V. Miscellaneous Receipts						2,800
(i)	Receipts realized from the sale of milk and coupons			4,20,407 2 6	..	800
(ii)	Receipts realized from other Schemes	..	..	1,09,050 2 6	..	..
(iii)	Receipts realized from the sale on account of unspent			..	8,000	8,000
	Balance of grants made by the Council	..	..	21,222 0 7	..	..
	Miscellaneous	..	..	1,8021 13 9	76,000	..
				5,68,701 10 4		..

XVI—contd.

Council of Agricultural Research for the year 1951-52

PAYMENTS

Head of Account	Expenditure during the year	Excess (—) or saving (+) over net grant	Remarks
	Rs.	Rs.	
3. Abstraction of horticultural literature	9,088 13 0	(—)488 13 0 (a)	(a) Inconsiderable
4. Drug plants ..	3 8 0	(+)6 8 0 (a)	
5. Revision of Handbook of Statistics for use in plant-breeding and agricultural problems	3,166 6 0	(—)366 6 0 (a)	
6. Monograph on insect pests of cultivated crops in India	754 14 0	(+)45 2 0 (a)	
(ii) Animal Husbandry			
1. Characteristics of grey breed	8,558 6 6	(+)41 9 6 (a)	
2. Utilization of kitchen swill as food for live-stock	..	..	

APPENDIX

Annual Accounts of Income and Expenditure of the Indian

RECEIPTS		G R A N T S	
Head of Account	Receipts during the year	Original	Net
	Rs.	Rs.	Rs.
VI. Debts and remittances		1,000	..
(i) Loans and advances ..	920 9 0	..	..
(ii) Deposits and advances repayable ..	1,64,744 7 0	..	..
(iii) Recoveries from the research staff on account of income tax, Provident Fund etc.	4,813 2 0	46,000	1,200
(iv) Deposits of I.C.A.R. Provident Fund ..	74,383 8 9	1,000	..
	2,44,861 10 9		
Total receipts and opening balance ..	60,84,643 13 1	700	..
	..	2,900	..
Investments and reinvestments ..	87,00,000 0 0	500	200
	..	..	..
		200	..
		10,000	..
	..	15,000	3,200
	..	..	7,500
Grand Total ..	1,47,84,643 13 1	38,330	17,200

XVI—contd.

Council of Agricultural Research for the year 1951-52

PAYMENTS

Head of Account	Expenditure during the year	Excess (—) or Saving (+) over net grant	Remarks
	Rs.	Rs.	
3. Monograph on Chemotherapy of animal trypanoso- miasis	4 14 0	(—)4 14 0	Inconsiderable
4. Monograph on 'Helminth parasites of domesticated ani- mals in India'	..	.. (a)	
5. Pilot Key Village Scheme, Delhi	1,250 5 7	(—)50 5 7 (a)	(a) Inconsiderable
6. Monograph on 'Maintenance of farm animals in health'	..	..	
7. Manual on 'Pre- paration of animals for Indian Markets'	..	..	
8. Manual on 'Breed- ing of farm animals in India'	..	..	(d) Scheme not taken during the year
9. Monograph on 'Statistical methods in A. H.'	.	(+)200 0 0 (d)	
10. Anatomy of ox ..	4 12 0	(—)4 12 0 (a)	
11. Inheritance of quantitative charac- teristics and laying qualities of eggs	..	..	
12. Camel Breeding I.C.A.R.	..	..	
13. Award of fellowships in A. H. subjects I.C.A.R.	3,185 6 0	(+)14 10 0 (a)	
14. Indigenous drugs used in veterinary practices	7,492 9 0	(+)7 7 0 (a)	
(iii) Miscellaneous			
1. Library	17,846 6 0	(—)646 0 0 (a)	

Annual Accounts of Income and Expenditure of the Indian

RECEIPTS		G R A N T S	
Head of Account	Receipts during the year	Original	Net
		Rs. 10,000	Rs. ..
		80,000	34,700
		5,710	7,800
		6,54,000	6,96,700
		2,00,000	..
		3,10,000	1,52,700
		4,490	3,800
		..	1,600
		5,000	1,600
		5,400	2,800
		7,000	1,04,500
		4,300	5,500

XVI—contd.

Council of Agricultural Research for the year 1951-52

PAYMENTS

Head of Account	Expenditure during the year	Excess (—) or saving (+) over net grant	Remarks
	Rs. A. P.	Rs. A. P.	
2. Statistician from the F.A.O. for teaching	..	..	
3. Integrated Publi- city work (Publicity Fund)	35,482 4 0	(—)782 4 0 (a)	
4. Co-ordination of Research	8,053 14 3	(—)253 14 3 (a)	
5. Cost of Office of the I.C.A.R.	6,96,700 0 0	..	
6. Construction of a building for the I.C.A.R.	..	..	
7. Co-ordinated crop- cutting experiments	1,53,264 2 0	(—)564 2 0 (a)	
8. Crop-cutting experi- ments on jute (hd. qrs.)	3,846 7 6	(—)46 7 6 (a)	
9. Crop-cutting experi- ments on jute/ Orissa	1,600 0 0	..	
10. Statistical analysis of data collected in sheep breeding schemes, Punjab & Mysore	1,607 9 0	(—)7 9 0 (a)	
11. Statistical analysis of data collected in breeding schemes at I.D.R.I. and Hosur (Madras)	2,824 1 0	(—) 4 1 0 (a)	
12. Editorial Staff for Indian Farming	1,05,371 11 9	(—)871 11 9 (a)	(a) Inconsiderable
13. Duplicating Section	6,235 1 9	(—)735 1 9 (c)	(c) More expenditure incurred in connection with meetings than was anticipated.

APPENDIX

Annual Accounts of Income and Expenditure of the Indian

RECEIPTS			
Head of Account	Receipts during the year	GRANTS	
		Original	Net
		Rs. 1,60,000	Rs. 7,38,500
		500	300
		..	13,500
		..	4,000
		4,800	2,500
		1,470	..
		..	2,900
		3,900	..
		14,080	11,200
		4,480	4,500
		5,300	3,300
		..	..
		7,000	6,200

XVI—contd.

Council of Agricultural Research for the year 1951-52

PAYMENTS

Head of Account	Expenditure during the year	Excess (—) or saving (+) over net grant	Remarks
	Rs. A. P.	Rs. A. P.	
14. Village projects, Delhi	6,59,732 14 0	(+)78,767 2 0 (b)	(b) Less actual expenditure than was anticipated
15. Publication of abstracts	305 1 0	(—)5 1 0 (a)	
16. Collection of marine fishery statistics	14,552 14 0	(—)1,052 14 0 (c)	(c) Excess due to payment of outstanding grant for previous year
17. Improvement of Livestock statistics	4,055 10 0	(—)55 10 0 (a)	
18. Fellowships in Statistics	2,670 8 0	(—)170 8 0 (a)	
19. Hand book on 'Indian Fodder and Forage Crops'	..	..	
C—GRANTS-IN-AID			
(i) Agriculture			
(a) Rice			
1. Rice breeding, Bombay	16,439 0 0	(—)1,539 0 0 (e)	
1A. Improvement of hillpaddy, Assam	..	..	
2. Rice breeding, Punjab	11,200 0 0	..	
3. Rice breeding, Coorg	4,500 0 0	..	
4. Rice breeding, Hyderabad	3,280 2 0	(+)19 14 0 (a)	
5. Rice breeding, Kashmir	3,120 0 0	(—)3,120 0 0 (f)	(f) Demand for funds received late in the year
6. Rice diseases, Madras	6,230 12 3	(—)30 12 3 (a)	

APPENDIX

Annual Accounts of Income and Expenditure of the Indian

RECEIPTS			
Head of Account	Receipts during the year	GRANTS	
		Original	Net
		Rs. -	Rs.
		7,900	7,400
		10,000	7,700
		5,940	..
		3,850	4,700
		6,530	..
		6,610	..
		24,800	18,900
		..	1,100
		6,300	3,000
		2,800	..
		2,300	..
		5,300	..
		2,800	..
		5,000	3,400
		7,880	7,900

XVI--contd.

Council of Agricultural Research for the year 1951-52

PAYMENTS

Head of Account	Expenditure during the year	Excess (—) or savings(+) over net grant	Remarks
	Rs. A. P.	Rs. A. P.	
7. Rice diseases, West Bengal	7,400 0 0	..	
8. Insects pests of paddy, W. Bengal	7,700 0 0	..	
9. Improvement of hill paddy, Orissa	..	..	
10. Boro paddy, W. Bengal	4,700 0 0	..	
11. Manurial experiments on paddy lands, W. Bengal	..	..	
12. Deep water paddy, Orissa	..	..	
12A. Increasing rice yield (C.R.R.I.)	18,940 0 0	(—)40 0 0 (a)	
(b) Wheat and other cereals			
13. Breeding rust-resistant wheat, I.A.R.I.	1,128 0 0	(—)28 0 0 (a)	
13A. Maize breeding, Hyderabad	3,000 0 0	..	
13b. Maize breeding, Rajasthan	..	..	
13c. Maize breeding, PEPSU	..	..	
13d. Wheat breeding, Rajasthan	..	..	
13e. Barley improvement, Rajasthan	..	..	
13f. Hybrid corn seeds, Almora	5,000 0 0	(—)1,600 0 0 (f)	
14 What breeding, Madhya Pradesh	7,970 0 0	(—)70 0 0 (a)	(a) Inconsiderable

APPENDIX

Annual Accounts of Income and Expenditure of the Indian

RECEIPTS			
Head of Account	Receipts during the year	GRANTS	
		Original	Net
		Rs.	Rs.
		6,560	12,000
		13,200	9,600
		7,000	6,900
		7,820	..
		16,830	13,600
		..	21,000
		1,35,880	} 2,19,100
		13,400	
		12,770	
		36,210	
		18,540	
		22,410	
		18,750	
		..	11,100
		900	3,500
		8,010	6,600

XVI—contd.

Council of Agricultural Research for the year 1951-52

PAYMENTS

Head of Account	Expenditure during the year	Excess(—) or savings(+) over net grant	Remarks
	Rs. A. P.	Rs. A. P.	
<i>Wheat and other cereals—contd.</i>			
15 Wheat rust research, Bombay	12,000 0 0		
16 Maize breeding, Pun- jab	9,642 0 0	(—) 42 0 0 (a)	
17 Maize breeding, U.P.	6,878 11 0	(+) 21 5 0 (a)	
18 Maize breeding, Bihar	..		
19 Maize breeding, W. Bengal	13,600 0 0		
20 Maize breeding, I.A.R.I.	20,992 0 0	(+) 8 0 0 (a)	
21 Co-ordinated wheat rust control sche- me	2,19,090 0 0	(+) 10 0 0 (a)	
22 (Mycological) Simla			
22A (Mycological) Delhi			
23 (Mycological) Agra			
24 (Mycological) (Bota- ny), Delhi			
25 (Mycological) Pusa			
26 (Mycological) Simla			
27 (Mycological) (M.B.) Indore			
(c) <i>Millets and Pulses</i>			
28 Pulse breeding, Mad- ras	11,100 0 0		
29 Pulse breeding, U.P.	8,289 7 0	(+) 10 9 0 (a)	(a) Inconsiderable
30 Pulse breeding, W. Bengal	6,600 0 0	..	

APPENDIX

Annual Accounts of Income and Expenditure of the Indian

RECEIPTS			
Head of Account	Receipts during the year	GRANTS	
		Original	Net
		Rs.	Rs.
		..	13,000
		260	4,300
		500	200
		7,080	12,200
		480	..
		5,750	4,400
		3,180	1,800
		1,400	..
		..	100
		..	9,500
		..	3,000
		..	8,100
		9,350	8,700
		11,130	17,000
		14,660	10,000
		9,300	..
		4,300	..

XVI—contd.

Council of Agricultural Research for the year 1951-52

PAYMENTS

Head of Account	Expenditure during the year			Excess (—) savings (+) over net grant			Remarks
	Rs.	a.	p.	Rs.	a.	p.	
(c) <i>Milts and Pulses—</i> <i>contd.</i>							
31. Pulse breeding, Bihar	13,003	6	0	(—) 3	6	0 (a)	
32. Pulse breeding, Orissa	4240	0	0	(+) 60	0	0 (a)	
33. Pulse breeding, Assam	225	0	0	(—) 25	0	0 (a)	
34. Pulse breeding, Hyderabad	12,200	0	0	..			
35. Pulse breeding, Mysore	..			..			
36. Pulse breeding, Madhya Bharat (Gwalior)	4,409	0	0	(—) 9	0	0 (a)	
37. Small millets, U.P.	1,753	0	0	(+) 46	9	0 (a)	
38. Small millets, Mysore	..			..			
39. Small millets, Bombay	66	8	0	(+) 33	8	0 (a)	
40. Gram wilt disease, Punjab	9,460	0	0	(+) 40	0	0 (a)	
41. Soyabeans, I.I.Sc., Bangalore	2,953	0	0	(+) 47	0	0 (a)	
42. Physiology of pulses Cal. Uty.	8,082	0	0	(+) 18	0	0 (a)	
43. Striga attack on <i>Sorghum</i> , Madras.	8,700	0	0	..			
44. Hybrid <i>cumbu</i> , Madras	17,000	0	0	..			
45. Insect pests of stored cereal grains, Punjab	10,000	0	0	..			
45 (a). <i>Jowar</i> and <i>Bajra</i> Breeding, Saurashtra	..			..			
45 (b). Gram pests, M.P.	..			..			

APPENDIX

Annual Accounts of Income and Expenditure of the Indian

RECEIPTS		G R A N T S	
Head of Account	Receipts during the year	Original	Net
		Rs.	Rs.
		..	..
		..	10,400
		1,250	..
		18,360	19,000
		..	7,000
		9,640	10,400
		15,980	20,300
		14,890	9,000
		300	2,200
		5,000	5,000
		..	200
		..	300
		6,280	7,700
		18,100	12,100
		5,200	8,000
		9,500	..

XVI—contd.

Council of Agricultural Research for the year 1951-52

PAYMENTS

Head of Account	Expenditure during the year			Excess (—) or saving (+) over net grant			Remarks
	Rs.	a.	p.	Rs.	a.	p.	
(d) Oilseeds							(a) Inconsiderable
46. pests and diseases of oil seeds (U.P.)	2	0	0	(—) 2	0	0	(a)
(e) Fruits							
47. Horticulture, Madras	10,368	0	0	(—) 32	0	0	(a)
48. Horticulture, Bihar	..			..			
49. Horticulture, M.P.	19,000	0	0	..			
50. Horticulture, Assam	6,988	0	0	(—) 12	0	0	(a)
51. Horticulture, Orissa	10,390	0	0	(—) 10	0	0	(a)
52. Horticulture, Hyderabad	20,325	0	0	(—) 25	0	0	(a)
53. Horticulture, Mysore	9,000	0	0	..			..
54. Horticulture, Kashmir	2,170	0	0	(—) 30	0	0	(a)
55. Orange cultivation, Coorg	5,000	0	0	..			
56. Mango necrosis, Lucknow	172	4	0	(—) 27	12	0	(a)
57. San Jose Scale Survey, Kashmir	747	4	0	(—) 447	4	0	(f) Excess due to expenditure incurred late in the year
58. Cytogenetics of mango and banana, Poona.	7,666	13	0	(—) 33	3	0	(a)
59. Banana research, Madras	11,493	0	0	(—) 607	0	0	(a)
60. Banana research, Bombay	8,000	0	0	..			
61. Banana research, West Bengal	..			..			

APPENDIX

Annual Accounts of Income and Expenditure of the Indian

RECEIPTS		G R A N T S	
Head of Account	Receipts during the year	Original	Net
		Rs.	Rs.
		600	4,000
		800	..
		4,480	2,800
		17,390	23,500
		600	..
		19,200	30,400
		9,630	15,000
		9,400	7,600
		3,690	..
		3,060	3,500
		..	200
		2,000	..
		2,000	..
		2,000	2,000
		6,400	..
		5,400	..

XVI—contd.

Council of Agricultural Research for the year 1951-52

PAYMENTS

Head of Account	Expenditure during the year	Excess (—) or savings (+) over net grant	Remarks
(c) <i>Fruits</i> —contd.	Rs. a. p.	Rs. a. p.	
62. Banana Research, Calcutta Uty.	4,000 0 0	..	
63. Yield data from fruit orchards, M.P.	..	..	
64. Citrus manurial trials, Punjab	2,820 0 0	(—) 20 0 0 (a)	
65. Fruit research stations, U.P.	23,000 0 0	(—) 500 0 0 (a)	
66. Fruit preservation, Assam	..	..	
67. Mycological & entomological investigations of fruits, U.P.	30,961 0 0	(—) 561 0 0 (a)	
68. Horticultural Investigation, U.P.	15,000 0 0	..	
69. Insects pests of fruits, U.P.	7,560 0 0	(—) 40 0 0 (a)	
70. Orange disease, Madras	..	..	
71. Research on orange, Madras	3,440 0 0	(—) 60 0 0 (a)	
72. Fumigation technique for imported fruits, I.A.R.I.	183 0 0	(—) 17 0 0 (a)	
72A. Training in fruit preservation, U.P.	..	..	
72B. Training in fruit preservation, Bihar	..	..	
72C. Training in fruit preservation, Punjab.	2,000 0 0	..	
72D. Cashewnuts, Madras	..	..	
72E. Cashewnuts, Bombay	..	..	

APPENDIX

Annual Accounts of Income and Expenditure of the Indian

RECEIPTS			
Head of Account	Receipts during the year	G R A N T S	
		Original	Net
		Rs.	Rs.
		4,600	..
		..	21,000
		8,100	6,300
		10,800	8,000
		7,890	3,200
		4,810	4,000
		7,220	7,200
		4,460	2,900
		3,650	..
		6,070	..
		8,550	7,000
		4,220	3,300
		23,000	..

XVI—contd.

Council of Agricultural Research for the year 1951-52

Head of Account	Expenditure during the year	Excess (—) or saving (+) over net grant	Remarks
	Rs.	Rs.	
(e) <i>Fruits</i> —contd.			
72 F. Cashewnuts, Tracancore-Cochin	..	..	
(f) <i>Vegetables</i>			
73. Potato breeding, I.A.R.I.	16,463 0 0	(+) 4,5370 0 0 (g)	(a) Inconsiderable
74. Intermediate hill station for potatoes			
74a. Improvement of vegetables, Bombay	6,300 0 0	..	(g) Less funds demanded than was anticipated
74b. Improvement of vegetables, U. P.	8,000 0 0	..	
75. Tuber crops, Bombay	3,176 0 0	(+) 24 0 0 (a)	
76. Tuber crops, Punjab	3,960 0 0	(+) 40 0 0 (a)	
77. Tuber crops, Bihar	7,202 0 0	(—) 20 0 0 (a)	
78. Tuber crops, Orissa	2,900 0 0	..	
79. Tuber crops, Mysore	..	..	
80. Tuber crops, U. P.	..	..	
81. Tuber crops, Madras	6,980 0 0	(+) 20 0 0 (a)	
82. Research on tomatoes, potatoes and other vegetables, B. H. Unty.	3,280 0 0	(+) 20 0 0 (a)	
83. Tapioca and sweet potato, Travancore-Cochin	..	..	

APPENDIX

Annual Accounts of Income and Expenditure of the Indian

RECEIPTS			
Head of Account	Receipts during the year	G R A N T S	
		Original	Net
		Rs.	Rs.
		..	..
		4,650	3,000
		1,600	..
		9,500	..
		4,000	..
		1,800	1,300
		14,090	8,600
		14,030	5,800
		2,940	1,500
		6,910	6,300
		1,170	1,000
		3,870	8,000
		..	12,550
		800	..
		14,700	9,200
		6,240	9,000
		11,690	4,900

XVI—contd.

Council of Agricultural Research for the year 1951-52

PAYMENTS

Head of Account	Expenditure during the year	Excess (—) or saaving (+) over net grants	Remarks
<i>(g) Other Crops</i>	Rs. a. p.	Rs. a. p.	
84. Sanhemp, U. P.	4 4 0	(—) 4 4 0 (a)	
85. Turmeric, Orissa	2,942 0 0	(+) 53 0 0 (a)	
85a. Zira diseases, Rajasthan	..	..	
85b. Medicinal plants, Madras	..	..	
85c. Medicinal plants, West Bengal	..	..	
85d. Azotobacter insulation of crops, West Bengal	1,300 0 0	..	
86. Cardamoms, Madras	8,540 2 0	(+) 59 14 0 (a)	
87. Pepper, Madras	5,838 0 0	(—) 33 0 0 (a)	
88. Ginger, Madras	1,460 0 0	(+) 40 0 0 (a)	
89. Chillies, Madras	6,300 0 0	..	
90. Cloves, Travancore	990 0 0	(+) 10 0 0 (a)	
91. Coriander diseases M. B. (Gwalior)	8,023 0 0	(—) 23 0 0 (a)	
<i>(h) Soils and Manures</i>			
92. Sewage farming Bangalore	12,547 11 6	(+) 2 4 6 (a)	
93. Control of erosion, Viswambarti Institute	..	..	
94. Trace elements in Indian soils, I. A. R. I.	9,210 0 0	(—) 10 0 0 (a)	
95. Soil improvement in spent up orchards, U. P.	9,000 0 0	..	
96. Nitrogen fixation in soils, I. A. R. I.	4,919 0 0	(—) 19 0 0 (a)	

APPENDIX

Annual Accounts of Income and Expenditure of the Indian

RECEIPTS			
Head of Accounts	Receipts during the year	GRANTS	
		Original	Net
		Rs.	Rs.
		2,880	13,300
		19,300	..
		24,700	13,600
		30,200	17,000
		23,000	..
		28,600	..
		25,000	23,000
		7,000	26,100
		17,000	8,700
		2,500	4,900
		..	11,600
		2,000	2,500
		42,300	..
		2,000	35,300
		15,200	..
		13,200	..

XVI—contd.

Council of Agricultural Research for the year 1951-52

PAYMENTS

Head of Account	Expenditure during the year	Excess (—) or saving (+) over net grants	Remarks
(h) <i>Soils and Manures</i> —contd.	Rs.	Rs.	
97. Phosphatic manuring I. A. R. I.	13,280 0 0	(+) 20 0 0 (a)	(a) Inconsiderable
98. Soil conservation, H. P.	..	..	
98a. Manurial Experiments, Madras	13,600 0 0	..	
98b. Manurial experiments, West Bengal	17,000 0 0	..	
98c. Manurial experiments, Bihar	..	..	
98d. Manurial experiments, Orissa	..	..	
(j) <i>Physiology</i>			
99. Plant physiology Mr. Boshi Sen	22,961 3 9	(+) 38 12 3 (a)	
(k) <i>Entomology</i>			
100. Schools of research	26,051 15 0	(+) 48 1 0 (a)	
101. Research on insecticides, Punjab	8,650 0 0	(+) 50 0 0 (a)	
102. Test with D.D.T., I.A.R.I.	4,950 0 0	(—) 50 0 0 (a)	
103. Test with D.D.T., Bombay	11,640 0 0	(—) 40 0 0 (a)	
104. Test with D.D.T., U.P.	2,450 0 0	(+) 50 0 0 (a)	
104A. Weed control, Poona, Madras, Bombay, U.P. & W.B.	..	..	
(l) <i>Mycology</i>			
105. Virus diseases Bombay	35,330 0 0	(—) 30 0 0 (a)	
105A. Virus diseases, Simla	..	..	
105B. Virus diseases, Delhi	..	..	

APPENDIX

Annual Accounts of Income and Expenditure of the Indian

RECEIPTS			
Head of Account	Receipts during the year	GRANTS	
		Original	Net
		Rs.	Rs.
		22,420	3,700
		2,770	17,300
		3,770	2,900
		6,600	5,000
		..	9,800
		5,000	54,500
		26,040	..
		30,090	..
		..	3,800
		10,100	2,000
		10,000	..
		2,580	..
		..	10,000

XVI—contd.

Council of Agricultural Research for the year 1951-52

PAYMENTS

Head of Account	Expenditure during the year			Excess (—) or savings (+) over net grants				Remarks
(l) Mycology—contd	Rs.	a.	p.	Rs. a. p.				
106. Schools of Research	3,560	0	0	(+)	40	0	0 (a)	(a) Inconsiderable
(m) General								
107. Introduction of new economic plants, I.A.R.I.	17,280	0	0	(+)	20	0	0 (a)	
108. Crop seeds, Delhi Uty.	2,830	0	0	(—)	30	0	0 (a)	
109. Monograph on 'Agriculture in ancient India,' I.A.R.I.	5,000	0	0		..			
(ii) Animal husbandry								
(a) Cattle breeding								
1. Livestock investigation Punjab,	9,820	8	0	(—)	20	8	0 (a)	
2. Improvement of Kangayan breed of cattle, Madras	54,450	0	0	(+)	50	0	0 (a)	
3. Cattle improvement and insurance, PEPSU	..				..			
4. Causes of degeneration of Indian cattle, I.V.R.I.	..				..			
5. Cattle improvement, U.P.	3,002	0	0	(—)	2	0	0 (a)	
5A. Pilot Key Village Travancore-Cochin	2,000	0	0		..			
5B. Pilot Key Village Other centres	..				..			
6. Cattle improvement, Cochin	..				..			
7. Pilot Key Village Scheme, U.P.	10,000	0	0		..			

APPENDIX

Annual Accounts of Income and Expenditure of the Indian

RECEIPTS		GRANTS	
Head of Account	Receipts during the year	Original	Net
		Rs.	Rs.
		20,000	14,000
		4,870	6,300
		8,200	1,900
		10,920	4,700
		..	300
		5,870	..
		..	2,400
		2,610	2,600
		..	23,000
		11,400	8,500
		..	3,100
		7,640	3,500
		50,000	..
		15,600	..
		25,000	30,700
		2,840	32,800

XVI—contd.

Council of Agricultural Research for the year 1951-52

PAYMENTS

Head of Account	Expenditure during the year	Excess (—) or saving (+) over net grant	Remarks
(a) <i>Cattle breeding</i> —contd.	Rs. AS. P.	Rs. AS. P.	
8. Artificial insemination, I. V. R. I.	14,018 0 0	(—) 18 0 0 (a)	(a) Inconsiderable
(b) <i>Goat and sheep breeding</i>			
9. Goat breeding, Punjab	6,260 0 0	(+) 40 0 0 (a)	
10. Goat breeding, Orissa	1,850 1 6	(+) 49 14 6 (a)	
11. Goat breeding, Cochin	4,700 0 0	..	
12. Angora goat breeding, Punjab	258 13 9	(+) 41 2 3 (a)	
13. Angora goat breeding, U.P.	2,633 8 0	(—) 2,633 8 0 (f)	(f) Demand for funds received late in the year
14. Survey of sheep, Rajasthan (Jaipur)	2,419 0 0	(—) 19 0 0 (a)	
15. Sheep breeding, Madras	2,610 0 0	(—) 10 0 0 (a)	
16. Sheep breeding, Bombay	23,264 0 0	(—) 264 0 0 (a)	
17. Sheep breeding, Punjab	8,510 0 0	(—) 10 0 0 (a)	
18. Sheep breeding, Bihar	3,093 0 0	(+) 7 0 0 (a)	
19. Sheep breeding, Kashmir	136 10 0	(+) 3,363 6 0 (h)	(h) Demand for funds not received
19A. Sheep and Wool Improvement on regional Basis, U.P.	8,050 0 0	(—) 8,050 0 0 (f)	
(c) <i>Animal nutrition</i>			
20. Animal nutrition, Madras	..	..	
21. Animal nutrition, Bombay	30,700 0 0	..	
22. Nutritive value of leafy fodders, I.V.R.I.	32,810 0 0	(—) 10 0 0 (a)	

APPENDIX

Annual Accounts of Income and Expenditure of the Indian

RECEIPTS			
Head of Account	Receipts during the year	GRANTS	
		Original	Net
		Rs.	Rs.
		32,210	..
		6,300	5,800
		3,400	..
		..	2,700
		..	9,300
		7,820	..
		6,000	5,000
		..	200
		5,240	3,900
		5,400	4,900
		..	4,600

XVI—contd.

Council of Agricultural Research for the year 1951-52

PAYMENTS

Head of Account	Expenditure during the year	Excess(—) or saving(+) over net grants	Remarks
		Rs.	
(c) Animal Nutrition —contd.			
23. Influence of trace elements on the health and production capacity of livestock I.V.R.I.	..	..	(a) Inconsiderable
23A. Standardisation of rations for ryots cattle, Orissa	5,850 0 0	(+) 50 0 0 (a)	
(d) Animal pests and diseases and cure			
24. Veterinary investigation officer (cattle), Travancore-Cochin	..	.	
25. Veterinary investigation officer (cattle), Assam	2,662 0 0	(+) 38 9 0 (a)	
26. Veterinary investigation officer (cattle), Punjab	9,326 9 0	(—) 26 9 0 (a)	
27. Veterinary investigation officer (cattle), Rajasthan	..	..	
28. Veterinary investigation officer (cattle), Kashmir	4,950 0 0	(+) 50 0 0 (a)	
29. Veterinary investigation officer (cattle), Bombay (Baroda)	173 0 0	(+) 27 0 0 (a)	
30. Veterinary investigation officer (cattle), Mysore	3,920 0 0	(—) 20 0 0 (a)	
31. V.I.O. (Sheep and Goats), Bombay	4,907 0 0	(—) 7 0 0 (a)	
32. V.I.O. (Sheep and Goats), Madras	4,595 15 6	(+) 4 1 6 (a)	

APPENDIX

Annual Accounts of Income and Expenditure of the Indian

RECEIPTS		GRANTS	
Head of Account	Receipts during the year	Original	Net
		Rs.	Rs.
		4,000	..
		5,000	..
		4,720	1,800
		500	4,000
		5,000	3,400
		4,380	..
		..	500
		32,530	27,300
		1,430	24,000
		32,000	17,500
		4,810	19,300
		5,810	6,700
		1,000	5,100
		450	9,300

XVI—contd.

Council of Agricultural Research for the year 1951-52

PAYMENTS

Head of Account	Expenditure during the year	Excess (—) or saving (+) over net grants	Remarks
	Rs. a. p.	Rs. a. p.	
(d) Animal pests and diseases and cure (contd.)			
32A. V.I.O. (Sheep and Goats), U.P.	2,554 0 0	(—) 2,554 0 0 (f)	(a) Inconsiderable
33. V.I.O. (Sheep and Goats), W. Bengal	..	..	
34. V.I.O. (Sheep and Goats), Punjab	1,784 0 0	(+) 16 0 0 (a)	
35. V.I.O. (Sheep and Goats), Bihar	3,901 0 0	(+) 99 0 0 (a)	
36. V.I.O. (Sheep and Goats), Orissa	3,400 0 0	..	(f) Demand for funds received late in the year
37. V.I.O. (Sheep and Goats), Mysore	3,470 0 0	(—) 3,470 0 0 (f)	
38. V.I.O. (Sheep and Goats), Rajasthan	491 0 0	(+) 9 0 0 (a)	
39. Tuberculosis and John's disease among animals, I.V.R.I.	27,290 0 0	(+) 10 0 0 (a)	
40. Helminth parasites, I.V.R.I.	24,000 0 0	..	
41. Vaccination against foot and mouth diseases, I.V.R.I.	17,490 0 0	(+) 10 0 0 (a)	
42. Damage caused by ticks and warble flies, I.V.R.I.	19,308 12 6	(—) 8 12 6 (a)	
43. Toxicology of indigenous drugs of India, Madras	6,060 0 0	(+) 640 0 0 (g)	(g) Less funds demanded than was anticipated
44. Helminthiasis of cattle, Madras	5,140 0 0	(—) 40 0 0 (a)	
45. Helminthiasis of cattle, Lucknow University	9,340 0 0	(—) 40 0 0 (a)	

APPENDIX

Annual Accounts of Income and Expenditure of the Indian

RECEIPTS

Head of Account	Receipts during the year	GRANTS	
		Original	Net
		Rs.	Rs.
		2,000	15,400
		7,190	9,100
		..	..
		8,000	2,500
		..	33,600
		..	4,200
		20,000	18,200
		4,200	5,000
		3,500	3,100
		29,900	6,900
		..	4,700
		..	15,600
		15,000	..
		..	1,500

XVI—contd.

Council of Agricultural Research for the year 1951-52

PAYMENTS

Head of Account	Expenditure during the year		Excess (—) or saving (+) over net grants				Remarks
	Rs.	a. p.		Rs.	a. p.		
(d) Animal pests and diseases and cure— <i>contd.</i>							
46. Diseases caused by anaerobes, I.V.R.I.	15,390	0 0	(+)	10	0 0	(a)	(a) Inconsiderable
47. Tuberulin testing, Madras	9,100	0 0		..			
48. Tuberulin testing, Bombay and Punjab	57	0 0	(—)	57	0 0	(a)	
48-A. Tuberulin testing, Bihar	2,470	0 0	(+)	30	0 0	(a)	
49. Bearing of nutrition on helminthic infection, I.V.R.I.	33,868	5 0	(—)	268	5 0	(a)	
50. Indigenous drugs used in veterinary medicines, Madras	4,170	0 0	(+)	30	0 0	(a)	
51. Control of bovine pleuro-pneumonia, Assam	18,200	0 0		..			
52. Investigation of mastitis, Bombay	4,950	0 0	(+)	50	0 0	(a)	
53. Investigation of mastitis, Mysore	3,140	0 0	(—)	40	0 0	(a)	
53-A. Use of lapinised virus against rinderpest, I.V.R.I.	6,870	0 0	(+)	30	0 0	(a)	
(e) Dairying							
54. Nutritive value of <i>vanaspathi</i> , I.V.R.I.	4,509	6 0	(+)	190	10 0	(a)	
55. Milk transport from villages to towns U. P.	15,559	0 0	(+)	41	0 0	(a)	
56. Rapid determination of fats, etc. of milk, Bombay	..			..			
57. Rapid determination of fats, etc. of milk, Bihar	1,540	0 0	(—)	40	0 0	(a)	

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APPENDIX

Annual Accounts of Income and Expenditure of the Indian

RECEIPTS			
Head of Accounts	Receipts during the year	GRANTS	
		Original	Net
		Rs.	Rs.
		6,430	..
		5,220	7,700
		..	500
		1,650	..
		..	24,300
		19,400	16,600
		16,620	13,600
		17,400	10,000
		20,560	..
		..	..
		20,850	36,600
		23,840	24,100
		..	300

XVI—contd.

Council of Agricultural Research for the year 1951-52

PAYMENTS

Head of Account	Expenditure during the year	Excess (—) or savings (+) over net grants	Remarks
	Rs. a. p.	Rs. a. p.	(a) Inconsiderable
(e) Dairying— <i>contd.</i>			
58. Rapid determina- tion of fats, etc. of milk, W. Bengal	..	..	
59. Rapid determina- tion of fats, etc. of milk, Punjab	7,682 3 0	(+) 17 13 0 (a)	
60. Standardising me- thods for the ana- lysis of ghee, I.D.R.I.	419 0 0	(+) 81 0 0 (a)	
61. Bacteriological quality of market milk, West Bengal	..	..	
62. Standardisation of the technique of manufacture to im- prove the market quality of ghee, I.D. R. I.	24,280 0 0	(+) 20 4 0 (a)	
63. Analysis of milk, I.D.R.I.	16,610 0 0	(—) 10 0 0 (a)	
64. Analysis of milk, I.D.R.I., Bombay	16,630 0 0	(—) 30 0 0 (a)	
65. Analysis of milk, I.D.R.I., U.P.	10,000 0 0	..	
66. Analysis of milk, I.D.R.I., Bihar	..	..	
67. Development of ghee Industry, M.P.	41 0 0	(—) 41 0 0 (a)	
68. Analysis of milk, Institute of Hygiene and Public Health	36,903 0 0	(—) 303 0 0 (a)	
69. Heat resistant flora in Indian milk, I.D. R.I.	24,130 0 0	(—) 30 0 0 (a)	
70. Ghee analysis, I.I. Sc., Bangalore	284 13 0	(—) 15 3 0 (a)	

APPENDIX

Annual Accounts of Income and Expenditure of the Indian

RECEIPTS			
Head of Accounts	Receipts during the year	GRANTS	
		Original	Net
		Rs.	Rs.
		6,000	5,000
		25,000	28,880
		..	..
		..	12,500
		..	..
		6,500	..
		..	..
		..	700
		..	..
		..	200
		500	..
		..	300
		16,950	..
		8,400	500
		5,000	9,000

XVI—contd.

Council of Agricultural Research for the year 1951-52

PAYMENTS

Head of Account	Expenditure during the year	Excess(—) or savings (+) over net grants	Remarks
	Rs. a. p.	Rs. a. p.	
Dairying— <i>contd.</i>			
71. Glyceride structure of ghee, I.I. Sc.	5,024 11 0	(—) 24 11 0 (a)	(a) Inconsiderable
(f) Wool			
72. Wool analysis, Bombay University	22,720 0 0	(+) 6,160 0 0 (g)	(g) Less funds demanded than was anticipated
73. Wool analysis, Bihar	..	..	
74. Sampling wool for measurement of quality, I.C.A.R.	12,645 0 0	(—) 145 0 0 (a)	
75. Wool analysis, Punjab	9 7 6	(—) 9 7 6 (a)	
(g) Poultry			
76. Diseases of poultry, Madras	2 15 6	(—) 2 15 6 (a)	
77. Diseases of poultry, Punjab	5 8 0	(—) 5 8 0 (a)	
78. Disease of poultry, M.P.	700 0 0	..	
79. Diseases of poultry, Bihar	1,089 0 0	(—)1,089 0 0 (f)	(f) Demand for funds received late in the year
80 Diseases of poultry, U. P.	239 0 0	(—) 93 0 0 (a)	
80-A Diseases of poultry, Mysore	..	..	
81. Diseases of poultry, Bombay	272 0 0	(+) 28 0 0 (a)	
82. Poultry research, Madhya Pradesh	12,000 0 0	(—)12,000 0 0 (f)	
83. Poultry research, Travancore-Cochin	510 0 0	(—) 10 0 0 (a)	
84. Helminth parasites affecting poultry	9,010 0 0	(—) 10 0 0 (a)	
I.V.R.I.			

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RECEIPTS

Head of Account	Receipts during the year	GRANTS	
		Original	Net
	Rs.	Rs.	Rs.
		4,970	1,400
		..	..
		3,800	3,700
		7,200	5,000
		6,100	..
		6,460	200
		4,500	6,300
		5,900	..
		5,000	..
		3,000	..
		24,100	14,800
		1,000	..

XVI—contd.

Council of Agricultural Research for the year 1951-52

PAYMENTS

Head of Account	Expenditure during the year	Excess (—) or savings (+) over net grants	Remarks
	Rs. a. p.	Rs. a. p.	
85. Duck breeding, Bihar	1,390 0 0	(+) 10 0 0 (a)	(a) Inconsiderable
(i) Fish			
86. Fishery research scholarship, Travancore	2,800 0 0	(—) 2,800 0 0	(f)
86-A. Piscicultural Research Annamma ai Uty	3,700 0 0	..	
(j) Apiculture			
86-B. Regional Bee Research station, Pb.,	5,000 0 0	..	
86-C. Regional Bee Research station, Madras	..	..	
87. Bee-keeping, Punjab	185 0 0	(+) 15 0 0 (a)	
(k) Miscellaneous			
88. Using cows for work, I.D.R.I.	6,300 0 0	..	
89. Using cows for work, Mysore	..	..	
90. Using cows for work, Other Centres	..	..	
91. Characteristics of Dangi and Niwari Cattle etc., Bombay			
(iii) Combined Agriculture and Animal Husbandry Schemes			
(a) Development			
1. Village Projects, Bombay (Baroda)	4,763 11 9	(+) 36 4 3 (a)	
2. Milk yielding trees, Bombay	..	..	

APPENDIX

Annual Accounts of Income and Expenditure of the Indian

RECEIPTS			
Head of Account	Receipts during the year	GRANTS	
		Original	Net
		Rs.	Rs.
		..	1,000
		9,000	15,400
		4,180	4,180
		16,930	..
		11,800	..
		4,500	5,300
		..	900
		..	750
		..	2,700
		..	500
		..	1,500
		..	1,100

XVI—contd.

Council of Agricultural Research for the year 1951-52

PAYMENTS

Head of Account	Expenditure during the year	Excess (—) or Saving (+) over net grants	Remarks
(a) Development— <i>contd.</i>	Rs. a p.	Rs. a. p.	(a) Inconsiderable
3. Village Projects, U.P.	984 0 0	(+) 16 0 0 (a)	
4. Extension Service Staff, Delhi	16,224 10 9	(—) 824 10 9 (a)	
5. Crop-cutting experiments on oil-seeds, U. P.	4,378 4 0	(—) 198 4 0 (a)	
6. Crop-cutting experiments on oilseeds, Madras.	..	..	
(b) Fodder and grazing			
7. Silage making, P.E.P.S.U.	..	..	
8. Kudzu Vine, I.A.R.I.	5,280 0 0	(+) 20 0 0 (a)	
(v) Miscellaneous Schemes.			
1. Crop-cutting experiments on paddy and wheat	921 0 0	(—) 21 0 0 (a)	
D. —Contribution to other Scientific Institutions			
(i) Indian			
1. Indian Society of Soil Science.	..	(—) 750 0 0 (h)	(h) Demand for funds not received
2. Indian Bee-Keepers, Association	..	(+) 2,700 0 0 (h)	
3. Current Science Association	..	(+) 500 0 0 (h)	
4. Indian Society of Genetics and Plant Breeding	..	(+) 1,500 0 0 (h)	
5. The Horticultural Society of India	1,135 0 0	(—) 35 9 0 (a)	

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Annual Accounts of Income and Expenditure of the Indian

RECEIPTS			
Head of Account	Receipts during the year	GRANTS	
		Original	Net
		Rs.	Rs.
		..	1,700
		..	2,000
		000	1,800
		..	500
		..	1,400
		..	1,100
		..	2,500
		..	91,600

XVI—contd.

Council of Agricultural Research for the year 1951-52

PAYMENTS

Head of Account	Expenditure during the year	Excess (—) or saving (+) over net grants	Remarks
	Rs. a. p.	Rs. a. p.	
(i) <i>Indian (contd.)</i>			
6. The Indian Dairy Science Association	1,632 12 0	(+) 67 4 0 (a)	
7. The Entomological Society of India	2,000 0 0		
8. Rural India, Bombay	1,845 12 0	(—) 45 12 0 (a)	
8A. Indian Society of Agri. Economics	500 0 0	..	(a) Inconsiderable
9. Indian Society of Agri. Statistics	1,381 0 0	(—) 19 0 0 (a)	
10. The Indian Phyto- pathological society	1,058 3 0	(—) 41 13 0 (a)	
11. Indian Botanical Society	2,500 0 0	..	
(ii) <i>Commonwealth and Imperial</i>			
12. Commonwealth Agricultural Bureaux	91,636 6 0	(—) 36 6 0 (a)	
13. Imperial Institute of Mycology			
14. Imperial Institute of Entomology			
15. Farnham House Laboratory			
16. Imperial Bureau of Dairy Science			
17. Fruit Preservation Research Station, Compen			
18. Empire Potato Scheme			

APPENDIX

Annual Accounts of Income and Expenditure of the Indian

RECEIPTS			
Head of Account	Receipts during the year	GRANTS	
		Original	Net
		Rs.	Rs.
		1,500	1,400
		5,000	4,80,000
		15,000	2,500

XVI—contd.

Council of Agricultural Research for the year 1951-52

PAYMENTS

Head of Accounts	Expenditure during the year	Excess (—) or Sav- ings (+) over net grants	Remarks
	Rs. as. p.	Rs. as. p.	
E—Debit and Re- mittance			
Loans and advances	1,405 0 0	(—) 5 0 0 (a)	(a) Inconsiderable
Deposits and advances repayable	4,84,031 4 8	(—)4,031 4 8	
Payments of Income- tax, Provident Funds, etc.	2,462 0 0	(+) 38 0 0 (a)	
Total ..	42,02,832 15 0	..	
Investment and Re- investment	101,60,000 0 0	..	
Closing Balance ..	4,21,810 14 1	..	
GRAND TOTAL / ..	1,47,84,643 13 1	..	

APPENDIX

II. Details of Advances

	Rs.
1. Permanent advance with the Secretary, I. C. A. R.	250 0 0
2. Permanent advance with the Rural Development Officer	200 0 0

III.

450 0 0

Particulars of securities etc.	Face value	Purchase value
1. 3% 2nd Victory loan 1959-61	5,00,000 0 0	5,03,125 0 0
2. 3% Victory Loan 1957		
(i)	16,62,800 0 0	17,27,753 2 0
(ii)	1,93,400 0 0	1,99,983 14 10
3. 3% Stock 1963-65	16,49,500 0 0	15,54,334 0 0
4. 2½% Stock 1962		
(i)	4,00,000 0 0	4,02,736 9 0
(ii)	5,50,000 0 0	5,50,000 0 0
5. 2¼% Loan of 1954	15,10,600 0 0	14,93,605 12 0
6. 2½% Loan of 1955	15,97,100 0 0	14,99,950 6 0
7. 4 Fixed Deposits receipts No. D70778 to D70781, for Rs. 50,000/- each repayable at a week's notice	2,00,000 0 0	..
8. 3 Fixed Deposits receipts No. H001481 to H001483 for Rs. 1,00,000/- each repayable after 9 months	3,00,000 0 0	..
9. 5 Fixed Deposits receipts No. J001065 to J001069 for Rs. 1,00,000/- each repayable after 12 months	5,00,000 0 0	..
10. 14 short terms deposits No. 27292 to 27305 repayable at a week's notice	7,00,000 0 0	..
11. 15 Treasury deposit receipts No. J001070 to J001084 for Rs. 1,00,000 each payable after 12 months at a week's notice	15,00,000 0 0	..
12. 20 short term deposit receipts No. E 27440 to E27459 for Rs. 50,000/- each repayable at a week's notice	10,00,000 0 0	..
13. 5 T. R. D. No. G002133 to G002137 for Rs. 1,00,000/- each repayable after 6 months	5,00,000 0 0	..
14. 5 short terms deposit receipts No. 27496 to 27500 for Rs. 1,00,000/- each repayable at a week's notice	5,00,000 0 0	.
15. 22 Twelve-year National Savings certificates No. 087031 to 087035, 087037 to 87041, 028496 to 028497, 063601 to 063610 for Rs. 5,000/- each	1,10,000 0 0	..
Total ..	133,73,400 0 0	

XVI—contd.

Securities	Rs.	
IV. Particulars of closing balances		
(i) Cash in hand with the Secretary, I. C. A. R.	250 0 0	..
(ii) In current account with the Imperial Bank of India, New Delhi and office	4,21,810 14 1	..
	4,22,060 14 1	..
Cash Balance	4,598 6 9	..
Imperial Bank of India, New Delhi	4,08,007 11 4	..
Post Office	9,204 12 0	..
	4,21,810 14 1	

J. V. A. NEHEMIAH

*Secretary,
Indian Council of Agricultural Research*

The accounts have been examined and according to best of my information and in consideration of the explanation given as a result of test audit of the accounts, they are correct.

R. P. GANGADHAR

*Examiner,
Outside Audit Department (Civil)
Central Revenues*

